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United States
Department of
Agriculture

Food Safety
and Inspection
Service

Science and
Technology

Compound Evaluation and Analytical Capability National Residue Program Plan 1991

**SCIENCE AND TECHNOLOGY
FOOD SAFETY AND INSPECTION SERVICE**

**COMPOUND EVALUATION AND ANALYTICAL CAPABILITY
1991 NATIONAL RESIDUE PROGRAM PLAN**

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PREFACE

National Residue Program

The Food Safety and Inspection Service (FSIS) of the U.S. Department of Agriculture (USDA) as part of its National Residue Program collects samples of meat and poultry at slaughtering establishments under its inspection authority and from import shipments at the ports of entry. The samples are analyzed for the presence of unacceptable residue concentrations of pesticides, animal drugs, and other potentially hazardous chemicals that may contaminate meat and poultry. These activities are carried out as part of the Agency's responsibilities under the Federal Meat Inspection Act and the Poultry Products Inspection Act to ensure that USDA-inspected products in commerce are safe, wholesome, and free of adulterating residues.

Purpose of Document

This document--now in its eighth edition--details the activities of the Food Safety and Inspection Service (FSIS) in its evaluation of compounds that may be present in meat and poultry and its development and implementation of analytical methods for detecting those compounds; it includes the National Residue Program Plan. The document serves as a reference source for those concerned with food safety and with FSIS activities in that area.

Section 1

Section 1 includes "Criteria for Compound Evaluation," which describes the procedure followed by FSIS in evaluating compounds for inclusion in the National Residue Program, and the "List of Compounds Considered." The list was compiled by reference to the separate entries in the Code of Federal Regulations (CFR) and the New Animal Drug Application (NADA) listing of the Food and Drug Administration. The list provides the compound name and appropriate CFR or NADA references. NADA references are used for approved animal drugs not listed in the CFR. The third column indicates the "residue designation" used by the National residue Program to denote the compounds or compound classes comprised by the Program. The fourth column gives the ranking assigned to the compound in the National Residue Program. The fifth column indicates the compounds included in the National Residue Program during a ten-year period and the specific years in which a compound was included; this column replaces the historical section of previous editions.

Section 2

Section 2 is a list of tolerances and action levels for the compounds.

Section 3

Section 3 defines the types of methods used by FSIS to conduct analyses and their suitability for regulatory use; defines key terms used to describe the methods; and lists the analytical methods for compounds in alphabetical order.

Section 4

Section 4 is the National Residue Program Plan for the calendar year 1991, which describes domestic and import program activities. The plan is a guide based on current information, assessment of precedence for testing, and FSIS analytical capability. It is dependent upon our having full staffing and is therefore affected by loss of personnel. The plan will be modified during the year as new information alters the original assessment.

Address for Comments

Please send comments regarding any aspects of the document to:

*Jeffrey Brown, Editor; USDA, FSIS, Science and Technology Program
300 12th Street SW, Washington, DC 20250*

Section 1

CRITERIA FOR COMPOUND EVALUATION AND RANKING

Introduction

Livestock and poultry may be exposed to many compounds during their life cycle. These compounds include primarily:

Pesticide chemicals approved for direct application to livestock and poultry or for treating crops that become components of animal feed or that are used in some way in the farm environment

Animal drugs used to treat or prevent disease or otherwise enhance production

Environmental contaminants

The Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA) establish the acceptable levels or limits of residues (tolerances or action levels) for these compounds in their respective areas of responsibility (pesticides, EPA; animal drugs, environmental contaminants, FDA) and the approved methods of use for specific crops or animals that ensure that limits will not be exceeded. If limits are not established for unavoidable contaminants, FSIS may request that FDA recommend action levels. Exposure of animals to environmental contaminants, or the use of pesticides or animal drugs in a way that does not conform with approved uses, can result in unacceptable amounts of residues of these chemicals in the edible tissues of animals at slaughter.

CFR References

Tolerances for these chemicals are listed in the Code of Federal Regulations (CFR) in 40 CFR 180 for pesticides, in 21 CFR 556 for animal drugs, and 21 CFR 109 for unavoidable contaminants. The approved use conditions for animal drugs are given in 21 CFR in parts 520, 522, 524, 526, 529 (new animal drugs not subject to certification), 540, 544, 546, 548 (antibiotic drugs for animal use), and 558 (new animal drugs for use in animal feed).

Need for Criteria

It is not feasible to monitor for residues of all of these chemicals in meat and poultry, nor is this necessary to adequately protect public health. It is, however, important to assess the likelihood that animals exposed to these chemicals may contain residues at levels of concern, and to conduct monitoring, when test methods are available, for those chemicals that are most likely to present the greatest potential risk. A hierarchical compound-assessment scheme is used for this purpose.

Compound Evaluation System (CES)

In the 1985 edition of this document, FSIS-Science (now Science and Technology) announced the implementation of a new Compound Evaluation System (CES). The CES was designed to provide the agency with a more systematic approach to the categorization of compounds with respect to their likelihood of occurrence in meat and poultry and their potential impact on public health. The CES was subjected to extensive external review by the tri-agency advisory board cited above (Surveillance Advisory Team) and was published. Briefly, the CES addresses the risk of residues in meat and poultry as a function of three major elements: whether a compound will leave a residue, and if so: hazard (adverse effects that may be produced by a given compound) and exposure (residue concentration; factors affecting concentration, such as use patterns, withdrawal times, etc.; duration of or frequency of consumption of product containing residues of concern). Compounds are ranked in a scheme that classifies a given pesticide, animal drug, or contaminant in any one of 24 categories. Compounds of greatest concern carry a designation of A-1 (high health hazard potential; high likelihood of residue occurrence); those compounds of least concern are designated D-4 (negligible health hazard potential; negligible likelihood of residue occurrence). The letter Z is used to indicate an element of the two-value system lacking the information needed for classification. Care is taken to avoid the use of exact numerical rankings that might suggest a high degree of sophistication possibly not justifiable because of data limitations or the assumptions inherent in the ranking process.

CRITERIA FOR COMPOUND EVALUATION AND RANKING

The assignment of a specific ranking is based on a review of information entered in a comprehensive set of CES worksheets prepared for each compound evaluated. These worksheets provide a permanent record and chronology of the nature and extent of the technical and scientific data that were considered. Certain compounds considered within the FSIS National Residue Program have been evaluated using the CES. It should be understood that the rankings are based strictly on data available to FSIS at the time and may well change as additional information becomes available in the open literature, from other agencies, or from the private sector. To further advance the CES effort, FSIS is using outside assistance in the preparation of a series of compound evaluation reports that will provide the basic information necessary to prepare the CES worksheets. To this end, a contract was awarded that calls for the preparation of evaluative reports on 50 compounds of potential concern to the agency. This work is now under way.

FSIS believes that the Compound Evaluation System is sufficiently flexible to permit rapid response to new information that may affect previous rankings and to allow for the use of scientific or expert judgement. It must be emphasized, however, that the CES was neither designed nor intended for use in the development of formal quantitative estimates of risk from meatborne residues. Rather, it provides a rational basis for changes in compound emphasis within the National Residue Program and encourages development of analytical methods for important compounds for which no methods exist. As such, the CES serves as a useful guide in the planning and allocation of FSIS Program resources for those residues considered to represent the greatest potential effect on public health. The CES is updated as appropriate to provide the FSIS with a constant, informative, and sound approach to dealing with residues in meat and poultry. Given the Program's experience with the CES, it has been decided to eliminate the old A-B-C-D rankings; compounds that are not ranked under the CES are marked "NR" for Not Ranked. The compounds in the List of Compounds Considered that have been assigned values in the CES are listed separately at the end of Section 1.B.

FSIS welcomes comments or suggestions regarding the CES; a copy of the CES document is available upon request. Send comments or requests regarding the CES to:

*USDA, FSIS, Science and Technology
Director, Residue Evaluation and Planning Division
300 12th St., S.W., Washington, D.C. 20250*

Selection of Compounds for Monitoring

Compounds are selected for monitoring and included in a plan for the calendar year based on several factors, including:

Compound ranking assigned

Whether a practical test method is available and is suitable for regulatory use

Whether the compound is measurable in a multi-residue method with which many compounds, even though all may not be assigned a high ranking, can be tested for at a relatively low cost

Monitoring or other experience that shows whether adulterating residues are present in meat and poultry

Not all of the hundreds of animal drugs and pesticides listed in the CFR are likely to expose animals to harmful residues. FSIS works from a list of about 400 compounds that includes certain environmental contaminants in addition to animal drugs and pesticides (Section 1.B). Some compounds are routinely included in monitoring because experience shows that without active enforcement adulterating residues will occur. Other compounds may be included in monitoring on a cyclical basis to confirm periodically that a potential residue problem does not exist. Cycling of compounds in monitoring allows the agency to include more compounds in the program than would otherwise be possible within its resources. Compounds rotated out of the program for a specific year are not disregarded; if the need arises, they can be added during that year. Over the last

CRITERIA FOR COMPOUND EVALUATION AND RANKING

ten years, virtually all the residues for which a suitable method was available have been monitored, except when a compound had an especially low rank.

In 1990 FSIS planned to conduct 92,629 sample unit analyses for 19 residue designations (denoting a compound or class of compounds); in 1991 FSIS plans to conduct 100,055 sample unit analyses for 13 residue designations. Table VI in Section 5 of this document shows the resource expenditure required by the sampling plan.

A Dynamic System

The process of compound evaluation and ranking is a dynamic one. Additional compounds have to be considered in the system, agricultural use practices change, and additional research on a compound's toxicity and its potential for leaving harmful residues may affect previous rankings. The agency uses an advisory board of scientists from EPA, FDA, and USDA (FSIS and the Agricultural Marketing Service) to identify significant new information that may affect a compound or ranking or indicate an urgent need for monitoring. This advisory relationship is defined in the Memorandum of Understanding among the three agencies published in the Federal Register on January 16, 1985.

LIST OF COMPOUNDS CONSIDERED

System of Compound Listing and Counting

CFR reference names, when available, are used for the primary entries; common names are given in square brackets, where applicable.

Isomers of a compound--compounds having the same percentage composition and molecular weight but differing in chemical or physical properties--are not listed separately.

Metabolites are listed in this edition with the parent compound.

Complex mixtures such as PCB's are listed as a single entry.

Residue designations denote the compound or compound class names used to compose the annual plan and under which residue results are reported.

In NRP Monitoring Plan provides the historical information given in the Section 4 of previous editions.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	CES Ranking	Residue Designation	In NRP Monitoring Plan
Acephate and metabolite	40 CFR 180.108	B-4	None	NA
Acepromazine	21 CFR 520.23 21 CFR 522.23	B-4	None	NA
2-Acetylamino-5-nitrothiazole	21 CFR 556.20	NR	None	NA
Acifluorfen and metabolites	40 CFR 180.383	NR	None	NA
Aflatoxin	none	A-4	None	NA
Aklomide and metabolite	21 CFR 556.30 21 CFR 558.35	Z-4	None	NA
Alachlor	40 CFR 180.249	A-2	None	NA
Albendazole	21 CFR 556.34 21 CFR 520.45	A-2	Benzimidazoles	1984-85, 1987-90
Aldicarb and metabolite	40 CFR 180.269	A-4	Carbamates	1989-90
Aldrin	none ¹	A-3	CHC's/COP's	1981-90
Aluminum tris (o-ethylphosphonate)	40 CFR 180.415	NR	None	NA
Ametryn	40 CFR 180.258	NR	None	NA
4-Amino-alpha-[(tert-butyl-amino)methyl]-3,5-dichlorobenzyl alcohol	None	B-4	None	NA
Amitraz and metabolites	40 CFR 180.287	B-3	None	NA
Amoxicillin trihydrate	21 CFR 556.38 21 CFR 540.103	NR	Penicillins	1981-90
Ampicillin	21 CFR 556.40 21 CFR 540.105/107	B-2	Penicillins	1981-90

¹ Tolerances revoked December 24, 1986.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	CES Ranking	Residue Designation	In NRP Monitoring Plan
Amprolium	21 CFR 556.50 21 CFR 520.100 21 CFR 558.55	NR	None	NA
Apramycin	21 CFR 556.52 21 CFR 520.110	NR	Same	1984
Arsanilate sodium	21 CFR 556.60 21 CFR 558.60	NR	Arsenic	1981-90
Arsanilic acid	21 CFR 556.60 21 CFR 558.62	C-1	Arsenic	1981-90
Arsenate, Calcium	40 CFR 180.192	NR	Arsenic	1981-90
Arsenate, Lead	40 CFR 180.194	NR	Arsenic	1981-90
Arsenic	21 CFR 556.60	NR	Arsenic	1981-90
Arsenite, Sodium	40 CFR 180.335	NR	Arsenic	1981-90
Atrazine	40 CFR 180.220	C-3	Triazines	1988-90
Avermectin	53 FR 22383	NR	None	NA
Azaperone	21 CFR 522.150	B-4	None	NA
Bacitracin	21 CFR 556.70 21 CFR 548.112/114 21 CFR 558.76/78	NR	None	NA
Bambermycins¹	21 CFR 558.95	NR	None	NA
Bendiocarb	None	NR	None	NA
Benomyl and metabolite	40 CFR 180.294	B-3	Benzimidazoles	1989-90
Bentazon and metabolite	40 CFR 180.355	NR	None	NA
BHC	None ²	B-2	CHC/COP's	1981-90
Bifenthrin	None	NR	None	NA
3,6-Bis (2-chlorophenyl)- 1,2,4,5-tetrazine	None	NR	None	NA

1 Common name, flavomycin.

2 Tolerances revoked July 16, 1986.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	CES Ranking	Residue Designation	In NRP Monitoring Plan
Bismuth subsalicylate	NADA 010-158	NR	None	NA
Bromoxynil	40 CFR 180.324	NR	None	NA
Bufencarb	40 CFR 180.255	NR	Carbamates	NA
Buquinolate	21 CFR 556.90 21 CFR 558.105	NR	None	NA
sec-Butylamine	21 CFR 561.60 40 CFR 180.321	NR	None	NA
Cacodylic acid	40 CFR 180.311	NR	Arsenic	1981-90
Cadmium	None	B-4	Trace Elements	NA
Calcium	None	NR	None	NA
Cambendazole	21 CFR 520.300	NR	Benzimidazoles	NA
Captafol	40 CFR 180.267	NR	None	NA
Captan	40 CFR 180.103	B-3	CHC/COP's	1988-90
Carbadox and metabolites	21 CFR 556.100 21 CFR 558.115	A-3	Same	1981-84, 1987-90
Carbarsone	21 CFR 556.60 21 CFR 558.120	C-2	None	NA
Carbaryl and metabolites	40 CFR 180.169	B-2	Carbamates	1989-90
Carbofuran and metabolites	40 CFR 180.254	C-3	Carbamates	1989-90
Carbomycin	21 CFR 556.110 21 CFR 520.1660a	NR	None	NA
Carbophenothion	40 CFR 180.156	NR	CHC/COP's	1981-82, 1985-86, 1988-90
Carboxin and metabolite	40 CFR 180.301	C-4	None	NA
Ceftiofur	21 CFR 556.113 21 CFR 522.313	NR	None	NA

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	CES Ranking	Residue Designation	In NRP Monitoring Plan
Cephapirin	21 CFR 556.115 21 CFR 526.363 21 CFR 529.365	NR	None	NA
Chloral hydrate	21 CFR 522.380	NR	None	NA
Chloramphenicol	21 CFR 555/555.111	A-2	Same	1981-86
Chlorbromuron	None ¹	NR	None	NA
Chlordane ²	None ³	A-2	CHC/COP's	1982-90
Chlordecone	None	NR	None	NA
Chlordimeform	40 CFR 180.285	NR	None	NA
Chlorhexidine dihydrochloride	21 CFR 556.120 21 CFR 524.402 21 CFR 529.400	NR	None	NA
Chlormadinone acetate	None ⁴	NR	None	NA
Chlorobutanol	21 CFR 556.140	NR	None	NA
2-Chloro-N,N-dial- lylacetamide [propachlor]	40 CFR 180.282	NR	None	NA
2-Chloro-1-(2,4- dichlorophenyl) vinyl diethyl phosphate [chlorfenvinphos]	40 CFR 180.322	NR	CHC/COP's	1981-82, 1985-86, 1988-90
2-Chloro-N-isopropyl- acetanilide	40 CFR 180.211	NR	None	NA
Chloroneb and metabolite	40 CFR 180.257	NR	None	NA
1-(4-Chlorophenoxy)- 3,3-dimethyl-1- (1H-1,2,4-triazol-1-yl)- 2-butanone and metabolite [triademefon]	40 CFR 180.410	NR	None	NA

1 Tolerances revoked May 4, 1988.

2 Residues of metabolized technical chlordane are reported as the sum of the isomers of chlordane, oxychlordane, and nonachlor.

3 Tolerances revoked December 24, 1986.

4 Tolerances withdrawn in June 1982.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	CES Ranking	Residue Designation	In NRP Monitoring Plan
2-(m-Chlorophenoxy) propionic acid	40 CFR 180.325	NR	None	NA
Chlorothalonil	40 CFR 180.275	NR	None	NA
Chlorothiazide	21 CFR 520.420	NR	None	NA
2-Chloro-1-(2,4,5- trichlorophenyl)vinyl dimethyl phosphate [stirofos]	40 CFR 180.252	NR	CHC/COP's	1981-82, 1985-86, 1988-90
Chlorpyrifos and metabolites	40 CFR 180.342	B-4	CHC/COP's	1981-82, 1985-86, 1988-90
Chlorpyrifos-methyl and metabolite	40 CFR 180.419	NR	None	NA
Chlorsulfuron	40 CFR 180.405	NR	None	NA
Chlortetracycline	21 CFR 556.150 21 CFR 558.128 21 CFR 546.110/113	NR	None	NA
Chorionic gonadotrophin	21 CFR 522.1081	NR	None	NA
Clenbuterol	None	B-4	None	NA
Clofentezine	53 FR 16780	NR	None	NA
Clopidol	21 CFR 556.160 21 CFR 558.175	NR	Same	1986
Cloprostenol sodium	21 CFR 522.460	B-4	None	NA
Clopyralid	40 CFR 180.431	NR	None	NA
Clorsulon	21 CFR 556.163 21 CFR 520.462	NR	Same	1986-89
Cloxacillin	21 CFR 556.165 21 CFR 540.814/815	NR	Penicillins	1981-90
Cobalt	None	NR	Trace Elements	NA
Copper	None	NR	Trace Elements	NA

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Copper glycinate	NADA 031-971	NR	None	NA
Copper naphthenate	NADA 012-991	NR	None	NA
Corticotropin	NADA 008-760	NR	None	NA
Coumaphos and oxygen analog	40 CFR 180.189 21 CFR 558.185 21 CFR 520.500	B-2	CHC/COP's	1981-82, 1985-86, 1988-90
Cresylic acid	None	NR	None	NA
Crufomate and metabolite	40 CFR 180.295	NR	Organophosphates	1981-82, 1985-86
Cyanide salts	None	NR	None	NA
Cyano (3-phenoxyphenyl) methyl-4-chloro-a-(methyl- ethyl) benzeneacetate [fenvalerate]	40 CFR 180.379	D-3	Pyrethroids	1990
Cyfluthrin	40 CFR 180.436	NR	None	NA
Cyhalothrin	40 CFR 180.438	NR	None	NA
Cyhexatin	40 CFR 180.1441	NR	None	NA
Cypermethrin	40 CFR 180.418	B-3	Pyrethroids	1990
Cyromazine ¹ and metabolite	40 CFR 180.414	B-3	Same	1984-86
2,4-D and metabolite	40 CFR 180.142/331	B-2	None	NA
Dalapon	40 CFR 180.150	A-3	None	NA
Daminozide	40 CFR 180.246	B-3	None	NA
DDT and metabolites	None ²	B-3	CHC/COP's	1982-90
Decoquinatate	21 CFR 556.170 21 CFR 558.195	Z-4	Same	1983-88
Deltamethrin	None	C-4	None	NA

¹ Trade name, Larvadex.

² Tolerances revoked December 24, 1986.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Demeton	40 CFR 180.105	NR	None	NA
Dexamethasone	21 CFR 520.540	NR	None	NA
Dialifor and oxygen analog	40 CFR 180.326	NR	None	NA
Diazinon	40 CFR 180.153	NR	CHC/COP's	1981-82, 1985-86
1,1-Dichloro-2,2-bis (p-ethylphenyl)ethane [perthane, ethylan]	40 CFR 180.139	NR	None	NA
Dibromochloropropane	None	NR	None	NA
Dibutyltin dilaurate	NADA 008-741 21 CFR 558.20	A-1	Same	NA
Dicamba and metabolite	40 CFR 180.227	NR	None	NA
3,5-Dichloro-N- (1,1-dimethyl-2- propynyl) benzamide and metabolites [pronamide, propyzamide]	40 CFR 180.317	NR	None	NA
4-(2,4-Dichloro- phenoxy butyric acid	40 CFR 180.331	NR	None	NA
2,4-Dichlorophenyl p-nitrophenyl ether [nitrofen]	None ¹	NR	None	NA
1-[[2-(2,4-Dichloro- phenyl)-4-propyl-1,3- dioxolan-2-yl]methyl]-1- H-1,2,4-triazole and metabolites [propiconazole]	40 CFR 180.434	NR	None	NA
Dichlorvos	21 CFR 556.180 21 CFR 520.600 21 CFR 558.205 40 CFR 180.235 ²	B-4	CHC/COP's	1981-82, 1985-86

¹ Tolerances revoked September 18, 1985.

² As 2,2-dichlorovinyl dimethyl phosphate.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Diclofop-methyl	40 CFR 180.385	NR	None	NA
Dieldrin	None ¹	NR	CHC/COP's	1982-1990
O,O-Diethyl S-[2-(ethylthio)ethyl] phosphorodithioate	40 CFR 180.183	A-2	None	NA
O,O-Diethyl-O-[p-(methylsulfinyl) phenyl] phosphorothioate [fensulfothion]	40 CFR 180.234	NR	None	NA
Diethylstilbestrol	None	NR	DES/Zeranol	1986-90
Difenzoquat	40 CFR 180.369	NR	None	NA
Diflubenzuron	40 CFR 180.377	NR	None	NA
Dihydrostreptomycin	21 CFR 556.200 21 CFR 540.874d,e 21 CFR 544.173/275	A-1	None	NA
Dimethipin	40 CFR 180.406	NR	None	NA
Dimethoate and oxygen analog	40 CFR 180.204	B-3	None	NA
O,O-Dimethyl O-p-(dimethylsulfamoyl) phenyl phosphorothioate and metabolite [famphur]	21 CFR 524.900 21 CFR 558.254 40 CFR 180.233	NR	None	NA
3,5-Dimethyl-4-(methylthio)phenyl methylcarbamate and metabolite (methiocarb)	40 CFR 180.320	NR	None	NA
O,O-Dimethyl S-[(4-oxo-1,2,3-benzotriazin-3(4H)-yl)methyl]phosphorodithioate [azinphosmethyl and as Guthion]	40 CFR 180.154	NR	None	NA

¹ Tolerances revoked December 24, 1986.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
N,N-Dimethylpiperi- dinium chloride	40 CFR 180.384	NR	None	NA
Dimethyl phosphate of a-methylbenzyl 3- hydroxy-cis-crotonate [crotoxyphos]	40 CFR 180.280	NR	None	NA
Dimethyl sulfoxide	21 CFR 524.660 40 CFR 180.1001	A-4	None	NA
Dimetridazole	None ¹	NR	Nitroimidazoles	1990
3,5-Dinitrobenzamide	21 CFR 556.220 21 CFR 558.376 ²	NR	None	NA
Dinoprost tromethamine	21 CFR 522.690	B-4	None	NA
Dinoseb	40 CFR 180.281	NR	None	NA
Dioxathion	40 CFR 180.171	NR	COP's	1985-1986
Diphenylamine	40 CFR 180.190	B-4	None	NA
Dipropyl iso- cinchomerionate	40 CFR 180.143	NR	None	NA
Diquat	40 CFR 180.226	NR	None	NA
Diuron	40 CFR 180.106	NR	None	NA
Dodecachloroocta- hydro-1,3,4-metheno- 2H-cyclobuta[cd]pentalene [Mirex]	None ³	NR	CHC/COP's	1981-1990
Dodine	40 CFR 180.172	NR	None	NA
Endosulfan and metabolite	40 CFR 180.182	NR	CHC/COP's	NA
Endrin	40 CFR 180.131	A-3	CHC/COP's	1981-1990

1 Tolerances and approvals for use withdrawn July 6, 1987.

2 As nitromide.

3 Tolerances revoked December 17, 1986.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Erythromycin	21 CFR 556.230 21 CFR 526.820 21 CFR 558.248 21 CFR 520.823	NR	Antibiotics	1981-1990
Estradiol	21 CFR 522.840	NR	None	NA
Estradiol benzoate	21 CFR 556.240 21 CFR 522.842/1940	NR	None	NA
Estradiol monopalmitate	None ¹	NR	None	NA
Estradiol valerate	21 CFR 522.850	NR	None	NA
Ethalfuralin	40 CFR 180.416	NR	None	NA
Ethephon	40 CFR 180.300	NR	None	NA
Ethion and oxygen analog	40 CFR 180.173	NR	COP's	1981-82, 1985-86
Ethofumesate and metabolites	40 CFR 180.345	NR	None	NA
Ethopabate	21 CFR 556.260 21 CFR 558.58	NR	None	NA
2-[1-(Ethoxyimino) butyl]-5-[2-(ethylthio) propyl]-3-hydroxy-2- cyclohexene-1-one [sethoxydim]	40 CFR 180.412 ²	NR	None	NA
Ethoxyquin	21CFR 172.140	NR	None	NA
5-Ethoxy-3-(trichloro- methyl)-1,2,4-thiadiazole and metabolite [etridazole]	40 CFR 180.370	NR	None	NA
Ethyl 4,4'-dichlorobenzi- late [chlorobenzilate]	40 CFR 180.109	NR	None	NA
Ethylene dibromide	40 CFR 180.126 ² 40 CFR 180.397	A-4	Same	1984

1 Approvals for use withdrawn May 4, 1988.

2 No tolerances have been established for residues in meat and poultry.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Ethyl 3-methyl-4-(methylthio)phenyl (1-methylethyl) phosphoramidate and metabolites [fenamiphos]	40 CFR 180.349	NR	None	NA
O-Ethyl-O-[4-(methylthio) phenyl] S-propyl phosphorodithioate [suprofos]	40 CFR 180.374	NR	None	NA
O-Ethyl S-phenyl ethylphosphonodithioate [fonofos]	40 CFR 180.221	NR	None	NA
S-[2-(Ethylsulfinyl) ethyl] O,O-dimethylphosphorothioate and metabolites [oxydemeton methyl]	40 CFR 180.330 ³	NR	None	NA
Fenarimol	40 CFR 180.421	NR	None	NA
Fenbendazole	21 CFR 556.275 21 CFR 520.905 21 CFR 558.258	B-3	Benzimidazoles	1984-90
Fenitrothion	none	NR	COP's	1985-1986
Fenprosalene	21 CFR 556.277 21 CFR 522.914	NR	None	NA
Fenridazon, potassium salt	40 CFR 180.423	NR	None	NA
Fenthion	40 CFR 180.214 21 CFR 524.920	C-3	None	NA
Florogestrone acetate	NADA 034-601	NR	None	NA
Fluazifop and butyl ester	40 CFR 180.411	NR	None	NA
Flucythrinate	40 CFR 180.400	NR	Pyrethroids	1990

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Flumethasone	21 CFR 520.960 21 CFR 522.960 21 CFR 524.960	NR	None	NA
Fluprednisolone	NADA 012-555	NR	None	NA
Fluprednisolone acetate	NADA 011-789	NR	None	NA
Fluridone	40 CFR 180.420	NR	None	NA
Fluvalinate	40 CFR 180.427	NR	None	NA
Fluzilazol	53 FR 34513	NR	None	NA
Folic acid	NADA 013-029	NR	None	NA
Follicle stimulating hormone	NADA 009-505 21 CFR 522.1822	NR	None	NA
Folpet	40 CFR 180.191	NR	None	NR
Furaltadone	none	NR	None	NA
Furazolidone	21 CFR 556.290 21 CFR 524.1005 21 CFR 558.262	A-1	None	NA
Furosemide	21 CFR 522.1010	NR	None	NA
Gasoline	none	NR	None	NA
Gentamicin sulfate	21 CFR 556.300 21 CFR 520.1044 21 CFR 522.1044 21 CFR 524.1044 21 CFR 529.1044	B-2	Antibiotics	
Gentian violet	none	A-2	Same	NA
Glyphosate and metabolite	40 CFR 180.364	NR	None	NA
Halofuginone	21 CFR 556.308 21 CFR 558.265	A-1	Same	1985-1986
Haloxon	21 CFR 556.310 21 CFR 520.1120	NR	None	NA

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
HCB	none	A-3	CHC/COP's	1982-1990
Heptachlor and heptachlor epoxide	40 CFR 180.104	A-1	CHC/COP's	1982-1990
Hetacillin, Potassium	21 CFR 540.829	NR	None	NA
Hexakis (2-methyl-2- phenylpropyl) distannoxane	40 CFR 180.362	NR	None	NA
Hexazinone	40 CFR 180.396	D-4	None	NA
Hexetidine	NADA 013-772	NR	None	NA
Hydrochlorothiazide	21 CFR 522.1150	NR	None	NA
Hydrocortisone acetate	21 CFR 556.320 21 CFR 524.1484d,h,i	NR	None	NA
5-[1-hydroxy-2-(isopropyl- amino)ethyl]	none	NR	None	NA
Hygromycin B	21 CFR 556.330 21 CFR 558.274	A-3	None	NA
Imazalil and metabolites	40 CFR 180.413	NR	None	NA
Iprodione	40 CFR 180.399	NR	None	NA
Ipronidazole and metabolite	none ¹	Z-4	Nitroimidazoles	1984-1990
Iron	none	NR	Trace Elements	NA
Isopropyl carbanilate [IPC, isoprprocarb]	40 CFR 180.319	NR	Carbamates	NA
Isopropyl m-chlorocar- banilate [CIPC, chlorpropham]	40 CFR 180.319	NR	None	NA
Ivermectin	21 CFR 556.344 21 CFR 520.1192, 3, 4, 5 21 CFR 522.1192	B-1	Same	1984-1990

¹ Tolerances and approvals for use revoked January 17, 1989.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Lasalocid	21 CFR 556.347 21 CFR 558.311	NR	Same	1984-1985
Lead	none	B-4	Trace Elements	NA
Levamisole	21 CFR 520.1240/42 21 CFR 522.1244 21 CFR 556.350 21 CFR 558.315	C-2	Same	1984-1986
Lidocaine hydrochloride	21 CFR 522.1258	NR	None	NA
Lincomycin	21 CFR 556.360 21 CFR 520.1263 21 CFR 522.1260 21 CFR 558.325	NR	None	NA
Lindane ¹	40 CFR 180.133	A-2	CHC/COP's	1982-1990
Linuron	40 CFR 180.184	A-3	CHC/COP's or None	NA
Lysergic acid diethylamide	none	NR	None	NA
Maduramicin ammonium	21 CFR 556.375 21 CFR 558.340	NR	None	NA
Malathion	40 CFR 180.111	NR	COP's	1981-82, 1985-86
Maneb	40 CFR 180.110	NR	None	NA
Manganese	21 CFR 582.5446	NR	Trace Elements	NA
Mebendazole	21 CFR 520.1320 21 CFR 520.1326	B-4	Benzimidazoles	NA
Mefluidide	40 CFR 180.386	NR	None	NA
Melengestrol acetate	21 CFR 556.380 21 CFR 558.342	B-4	Same	1981
N-(Mercaptomethyl) phthalimide S-(O,O-dimethylphos- phorodithioate) and metabolite [phosmet]	40 CFR 180.261 21 CFR 524.1742	NR	None	NA

¹ The gamma isomer of BHC.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Mercury	none	NR	None	NA
Metalaxyl and metabolite	40 CFR 180.408	NR	None	NA
Methamidophos ¹	40 CFR 180.315	NR	None	NA
Methanearsonic acid	40 CFR 180.289	NR	Arsenic	NA
Methomyl	40 CFR 180.253	NR	Carbamates	NA
Methoprene	40 CFR 180.359	NR	None	NA
Methoxychlor	40 CFR 180.120	D-4	CHC/COP's	1982-1990
Methyl bromide	none	B-4	None	NA
2-Methyl-4-chloro- phenoxyacetic acid and metabolite [MCPA]	40 CFR 180.339	NR	None	NA
6-Methyl-1,3-dithiolo [4,5-b]quinoxalin-2-one [oxythioquinox]	40 CFR 180.338	NR	None	NA
Methylene chloride	40 CFR 180.1010	A-2	None	NA
1-Methylethyl 2- ((ethoxy((1-methylethyl) amino)phosphinothioyl) oxy)benzoate and metabolites [isofenphos]	40 CFR 180.387	NR	None	NA
Methyl parathion	40 CFR 180.121	NR	COP's	1981-82, 1985-86
Metiram	40 CFR 180.217 ²	NR	None	NA
Metolachlor and metabolites	40 CFR 180.368	NR	None	NA
Metoserpate hydrochloride	21 CFR 556.410 21 CFR 520.1422	NR	None	NA
Metribuzin	40 CFR 180.332 ³	NR	None	NA

¹ Also listed as O,S-dimethyl phosphoramidithioate, a metabolite of acephate.

² As Polyram.

³ As Sencor.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Metsulfuron methyl	40 CFR 180.428	NR	None	NA
Monensin	21 CFR 556.420 21 CFR 520.1448 21 CFR 558.355	B-3	Same	1983-1984
Monuron	none	NR	None	NA
Monuron-TCA	none	NR	None	NA
Morantel tartrate	21 CFR 556.425 21 CFR 520.1450 21 CFR 558.360	NR	Tartrates	1983-1984
Myclobutanil	40 CFR 180.443	NR	None	NA
Naled and metabolite	40 CFR 180.215	B-4	None	NA
Naloxone hydrochloride	21 CFR 522.1462	NR	None	NA
Narasin	21 CFR 556.428 21 CFR 558.363	NR	None	NA
Neomycin sulfate	21 CFR 556.430 21 CFR 522.1484 21 CFR 524.1484	B-3	Antibiotics	1981-90
Neostigmine methyl sulfate	21 CFR 522.1503	NR	None	NA
Nequinat	21 CFR 556.440 21 CFR 558.365	NR	None	NA
Nicarbazin	21 CFR 556.445 21 CFR 558.366	NR	Same	1988-1990
Nickel	none	NR	Trace Elements	NA
Nicotine	40 CFR 180.167a	NR	None	NA
Nifuraldezone	none	NR	None	NA
Nitrapyrin and metabolite	40 CFR 180.350	NR	None	NA
Nitrofurazone	21 CFR 524.1580 21 CFR 558.370	B-1	None	NA

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Norflurazon and metabolite	40 CFR 180.356	NR	None	NA
Novobiocin	21 CFR 556.460 21 CFR 558.415	NR	None	NA
Nystatin	21 CFR 556.470 21 CFR 558.430	NR	None	NA
N-Octyl bicyclo- heptenedicarboximide [dimelone, dimethyl carbate]	40 CFR 180.367	NR	None	NA
Oleandomycin	21 CFR 556.480 21 CFR 558.435	NR	None	NA
Ormetoprim	21 CFR 556.490 21 CFR 558.575	NR	None	NA
Oryzalin	40 CFR 180.304	NR	None	NA
Oxadiazon and metabolites	40 CFR 180.346	NR	None	NA
Oxfendazole	21 CFR 520.1628-30	NR	Benzimidazoles	1990
Oxyfluorfen	40 CFR 180.381	NR	None	NA
Oxytetracycline hydrochloride	21 CFR 556.500 21 CFR 558.450 21 CFR 520.1660 21 CFR 522.1660	NR	Antibiotics	1981-90
Oxytocin	21 CFR 522.1680	NR	None	NA
Paraquat	40 CFR 180.205	A-4	None	NA
Parathion	40 CFR 180.121	NR	COP's	1981-82, 1985-86
PBB's (Polybrominated biphenyls)	none	NR	Same	1982
PCB's (Polychlorinated biphenyls)	21 CFR 109.30	A-4	CHC/COP's	1981-1990

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Penicillin, procaine and procaine G, penicillin G	21 CFR 556.510 21 CFR 558.460 21 CFR 540.874	NR	Penicillins	1981-90
Pentachlorophenol (PCP)	none	B-1	Same	NA
Permethrin and metabolites	40 CFR 180.378	B-2	Pyrethrins	1990
Phencyclidine	none	NR	None	NA
Phenothiazine	40 CFR 180.319 21 CFR 558.20	NR	None	NA
o-Phenylphenol	40 CFR 180.129	NR	None	NA
Phorate	40 CFR 180.206	NR	None	NA
Phosalone	40 CFR 180.263	NR	None	NA
Picloram	40 CFR 180.292	C-4	None	NA
Piperazine	21 CFR 520.1802 21 CFR 558.20	NR	None	NA
Piperonyl butoxide	40 CFR 180.127	NR	None	NA
Pirimiphos-methyl and metabolites	40 CFR 180.409	NR	None	NA
Pituitary luteinizing hormone	21 CFR 522.1820	NR	None	NA
Poloxalene	21 CFR 558.464 21 CFR 558.465	NR	None	NA
Polymixin	21 CFR 544.373b	NR	None	NA
Prednisolone	21 CFR 556.520 21 CFR 522.1880-1890	NR	None	NA
Prednisone	21 CFR 556.530	NR	None	NA
Profenofos	40 CFR 180.404	NR	None	NA
Profluralin	40 CFR 180.348	NR	None	NA

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Progesterone	21 CFR 556.540 21 CFR 522.1940	NR	None	NA
Prometryn	40 CFR 180.222	C-3	Thazines	NA
Propanil	40 CFR 180.274	A-4	None	NA
Proparacaine hydrochloride	21 CFR 524.1982	NR	None	NA
Propargite	40 CFR 180.259	NR	None	NA
Propazine	40 CFR 180.243	C-4	Triazines	NA
Propiopromazine	21 CFR 520.2002 21 CFR 522.2002	NR	None	NA
Pyrantel tartrate	21 CFR 556.560 21 CFR 520.2045 21 CFR 558.485	NR	Tartrates	1983-84
Pyrethrins	40 CFR 180.128	NR	None	NA
Quizalofop ethyl	40 CFR 180.441	NR	None	NA
Reserpine	none	NR	None	NA
Robenidine hydrochloride	21 CFR 556.580 21 CFR 558.515	NR	None	NA
Ronnel	40 CFR 180.177 21 CFR 558.525 21 CFR 520.2080	NR	CHC/COP's	1981-82, 1985-86, 1988-90
Roxarsone	21 CFR 556.60 21 CFR 558.530	C-1	Arsenic	1983-1990
Salicylic acid	21 CFR 556.590 21 CFR 529.2090	NR	None	NA
Salinomycin	21 CFR 558.550	NR	None	NA
Selenium	21 CFR 522.2100 21 CFR 573.920	NR	None	NA
Silvex	40 CFR 180.340	A-3	None	NA

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Simazine	40 CFR 180.213	C-3	Triazines	1988-1990
Spectinomycin dihydrochloride	21 CFR 556.600 21 CFR 520.2122 21 CFR 522.2120	B-2	None	NA
Streptomycin	21 CFR 556.610 21 CFR 544.110-973b 40 CFR 180.245	A-3	Antibiotics	1981-90
Styrene	none	C-2	None	NA
Sulfabromomethazine	21 CFR 556.620 21 CFR 520.2170	NR	Sulfonamides	1983-90
Sulfachloropyrazine monohydrate, sodium	21 CFR 556.625 21 CFR 520.2184	NR	None	NA
Sulfachlorpyridazine	21 CFR 556.630 21 CFR 520.2200 21 CFR 522.2200	NR	Sulfonamides	1984-90
Sulfadiazine	21 CFR 520.2611	NR	Sulfonamides	1984-90
Sulfadimethoxine	21 CFR 556.640 21 CFR 520.2220 21 CFR 522.2220 21 CFR 558.575	NR	Sulfonamides	1983-90
Sulfaethoxypyridazine	21 CFR 556.650 21 CFR 520.2240 21 CFR 522.2240 21 CFR 558.579	NR	Sulfonamides	1984-90
Sulfamethazine	21 CFR 556.670 21 CFR 520.2260 21 CFR 522.2260	B-1	Sulfonamides	1983-90
Sulfamethoxypyridazine	21 CFR 520.2300	NR	Sulfonamides	1984-90
Sulfanitran	21 CFR 556.680 21 CFR 520.2320 21 CFR 558.376	NR	Sulfonamides	1990
Sulfapyridine	none	NR	Sulfonamides	1984-90
Sulfaquinoxaline	21 CFR 520.2325 21 CFR 558.586	B-1	Sulfonamides	1983-90

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Sulfathiazole	21 CFR 556.690	B-1	Sulfonamides	1983-90
Sulfisoxazole	21 CFR 520.2330	NR	None	NA
Sulfomyxin	21 CFR 556.700 21 CFR 522.2340	NR	None	NA
2,4,5-T	none	A-3	None	NA
Tebuthiuron	40 CFR 180.390	NR	None	NA
Terbacil and metabolites	40 CFR 180.209	NR	None	NA
Terbufos	40 CFR 180.352	NR	None	NA
Terbutylazine	40 CFR 180.333	NR	Triazines	NA
Terbutryn	40 CFR 180.265	NR	None	NA
Terpene polychlorinates	none ¹	NR	CHC/COP's	NA
Testosterone propionate	21 CFR 556.710	NR	None	NA
Tetracycline hydrochloride	21 CFR 556.720 21 CFR 546.180,a,h,i	B-3	Antibiotics	1981-90
Tetradifon	40 CFR 180.174	NR	None	NA
Thiabendazole and metabolite	21 CFR 556.730 40 CFR 180.242 21 CFR 558.615 21 CFR 520.2380	B-2	Benzimidazoles	1985-90
Thiamylal, Sodium	21 CFR 522.2424	NR	None	NA
Thidiazuron	40 CFR 180.403	NR	None	NA
Thiobencarb	40 CFR 180.401	NR	None	NA
Thiophanate-methyl and oxygen analog	40 CFR 180.371	NR	None	NA
Thiram	40 CFR 180.132	NR	None	NA
Tiamulin	21 CFR 556.738 21 CFR 520.2455 21 CFR 558.600	D-3	None	NA

¹ Strobane.

LIST OF COMPOUNDS CONSIDERED

Compounds/ Products	Reference	Ranking	Residue Designation	In NRP Monitoring Plan
Toxaphene	40 CFR 180.138	A-2	CHC/COP's	1981-1990
Trenbolone acetate	21 CFR 556.739 21 CFR 522.2476	NR	None	NA
Triamcinolone acetonide	21 CFR 520.2482	NR	None	NA
Triasulfuron	54 FR 18020	NR	None	NA
S,S,S-Tributyl phosphorotrithioate [DEF]	40 CFR 180.272	NR	None	NA
Trichlorfon	40 CFR 180.198 ¹ 21 CFR 520.1326/2520	B-3	COP's	
Triclopyr and metabolite	40 CFR 180.417	NR	None	NA
Trifluralin	40 CFR 180.207	C-4	None	NA
Triphenyltin hydroxide	40 CFR 180.236	B-4	None	NA
Tylosin	21 CFR 556.740 21 CFR 520.2640 21 CFR 522.2640 21 CFR 524.2640 21 CFR 558.625	D-2	Antibiotics	1985-1990
Virginiamycin	21 CFR 556.750 21 CFR 558.635	D-4	None	NA
Xylazine	21 CFR 522.2662	Z-4	None	NA
Zeranol and metabolite	21 CFR 556.760 21 CFR 522.2680	C-2	DES/Zeranol	1986-1989
Zinc	none	D-4	Trace Elements	NA
Zinc ion and maneb, coordination product [mancozeb]	40 CFR 180.176	NR	None	NA
Zineb	40 CFR 180.115	NR	None	NA
Zoalene and metabolite	21 CFR 556.770	NR	None	NA

¹ As dimethyl (2,2,2-trichloro-1-hydroxyethyl)phosphonate.

LIST OF COMPOUNDS CONSIDERED

Compounds Ranked Under Compound Evaluation System (CES)

Compound	CES Ranking	Year of Publication
Acephate	B-4	1989
Acepromazine	B-4	1991
Aflatoxin	A-4	1985
Aklomide	Z-4	1991
Alachlor	A-2	1985
Albendazole	A-2	1987
Aldicarb	A-4	1986
Aldrin	A-3	1986
Ametryn	D-4	1990
4-Amino-alpha-[(tert-butylamino)methyl]-3,5-dichlorobenzyl alcohol	B-4	1990
Amitraz	B-3	1989
Ampicillin	B-2	1985
Ampicillin trihydrate	B-2	1985
Amprolium	A-4	1990
Arsanilic acid	C-1	1987
Atrazine	C-3	1985
Azaperone	B-4	1986
Benomyl	B-3	1986
BHC	B-2	1987
Cadmium	B-4	1985
Captan	B-3	1987
Carbadox	A-3	1987
Carbarsone	C-2	1987
Carbaryl	B-2	1988
Carbofuran	C-3	1986
Carboxin	C-4	1987
Chloramphenicol	A-2	1985
Chloramphenicol palmitate	A-2	1985
Chlordane (technical)	A-2	1987
Chlorpyrifos	B-4	1986
Clenbuterol	B-2	1991
Cloprostenol	B-4	1988
Clorsulon	D-4	1990
Coumaphos and oxygen analog	B-2	1988
Cyano(3-phenoxyphenyl) methyl-4-chloro-alpha-(methylethyl) benzeneacetate	D-3	1989
Cyromazine	B-3	1989
2, 4, D (technical)	B-2	1987
Dalapon	A-3	1985
Daminozide	B-3	1985
DDT	B-3	1989
Decoquinate	Z-4	1986
Deltamethrin	C-4	1989
Dibutyltin dilaurate	A-1	1988

LIST OF COMPOUNDS CONSIDERED

Compounds Ranked Under Compound Evaluation System (CES)

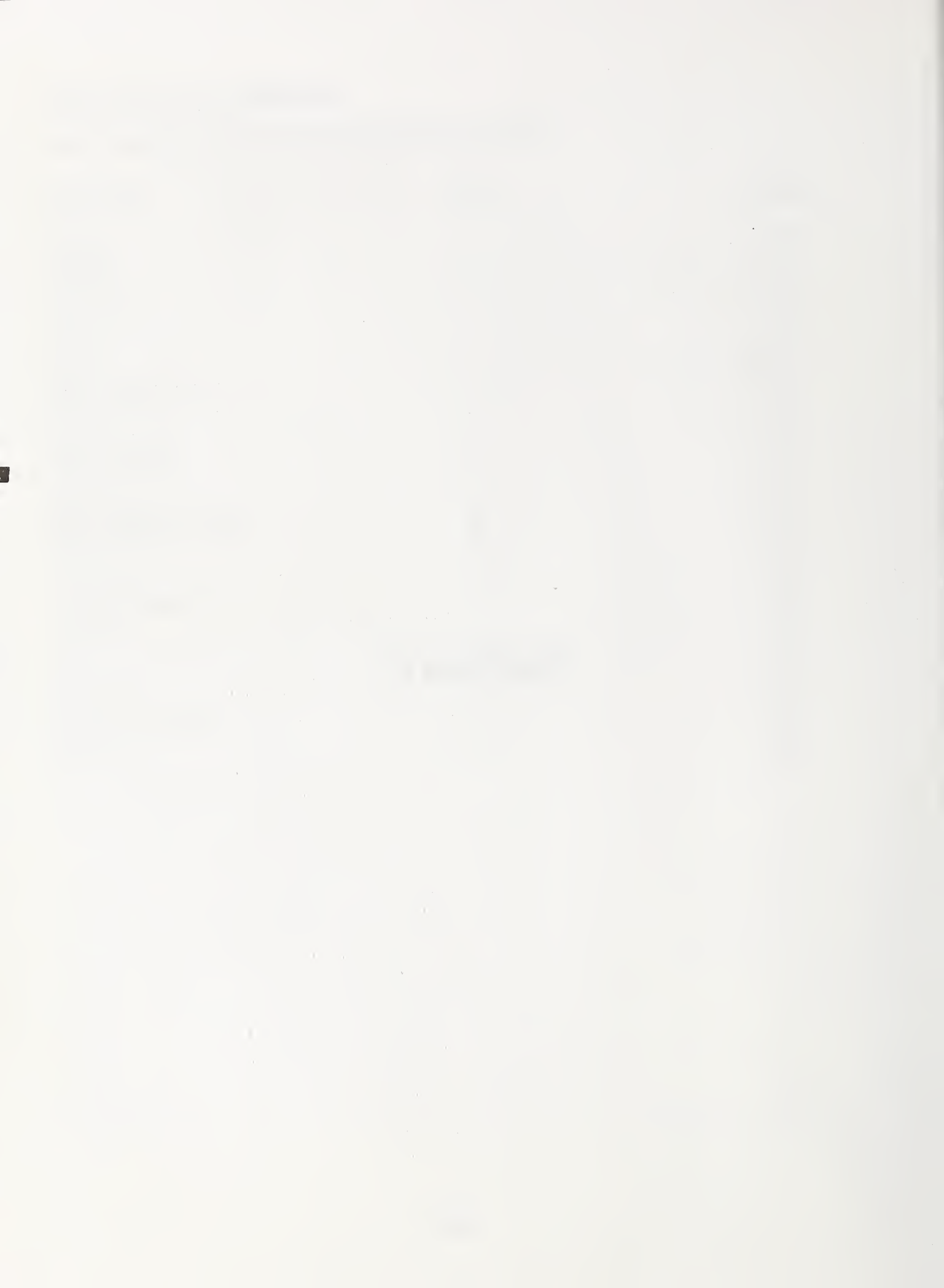
Compound	CES Ranking	Year of Publication
Dichlorvos	B-4	1987
O,O-diethyl S-[2-(ethylthio)ethyl] phosphorodithioate	A-2	1988
Dihydrostreptomycin	A-1	1989
Dimethoate	B-3	1986
Dimethyl sulfoxide	A-4	1989
Dinoprost tromethamine	B-4	1988
Diphenylamine	B-4	1985
Endrin	A-3	1986
Ethylene dibromide	A-4	1986
Fenbendazole	B-3	1987
Fenthion	C-3	1985
Furazolidone	A-1	1987
Gentamicin sulfate	B-2	1986
Gentian Violet	A-2	1991
Halofuginone	A-1	1989
HCB	A-3	1989
Heptachlor and heptachlor epoxide	A-1	1987
Hexazinone	D-4	1985
5-[1-hydroxy-2-(isopropylamino)ethyl]	D-4	1990
Hygromycin B	A-3	1991
Ipronidazole	Z-4	1986
Ipronidazole hydrochloride	Z-4	1986
Ivermectin	B-1	1986
Lead	B-4	1985
Levamisole	C-2	1985
Levamisole hydrochloride	C-2	1985
Lindane	A-2	1986
Linuron	A-3	1989
Mebendazole	B-4	1986
Melengestrol acetate	B-4	1989
Methamidophos	B-4	1990
Methoxychlor	D-4	1987
Methyl bromide	B-4	1986
Methylene chloride	A-2	1986
Monensin	B-3	1985
Monuron	B-4	1990
Naled	B-4	1987
Neomycin sulfate	B-3	1986
Nicarbazin	B-3	1990
Paraquat	A-4	1986
PCB's	A-4	1985
Pentachlorophenol (PCP)	B-1	1985
Permethrin	B-2	1987

LIST OF COMPOUNDS CONSIDERED

Compounds Ranked Under Compound Evaluation System (CES)

Compound	CES Ranking	Year of Publication
Picloram	C-4	1989
Propanil	A-4	1991
Propazine	C-4	1988
Prometryne	C-1	1987
Roxarsone	C-1	1987
Silvex	A-3	1986
Simazine	C-3	1988
Spectinomycin	B-2	1991
Streptomycin	A-3	1986
Styrene	C-2	1989
Sulfamethazine	B-1	1985
Sulfaquinoxaline	B-1	1987
Sulfathiazole	B-1	1987
2,4,5-T	A-3	1985
Tetracycline hydrochloride	B-3	1986
Thiabendazole	B-2	1987
Thiram	A-2	1990
Toxaphene	A-2	1985
Trenbolone acetate	C-4	1990
Xylazine	Z-4	1986
Zeranol	C-2	1986
Zinc	D-4	1985
Trichlorfon	B-3	1985
Trifluralin	C-4	1986
Triphenyltin hydroxide	B-4	1986
Tylosin	D-2	1989
Virginiamycin	D-4	1989

Section 2



1991 RESIDUE LIMITS

Introduction

This section provides information on residue limits in meat and poultry products applied by FSIS (as of July 1, 1990). These limits include tolerances and action levels developed by the Environmental Protection Agency (EPA) for pesticide chemicals, and by the Food and Drug Administration (FDA) for animal drugs and unavoidable contaminants. These limits are derived in most cases from the Code of Federal Regulations (CFR): pesticide limits from 40 CFR 180, those for animal drugs from 21 CFR 556, and unavoidable contaminants from 21 CFR 109. The approved use conditions for animal drugs can be found in 21 CFR 520, 522, 524, 526, 529 (new animal drugs not subject to certification), 540, 544, 546, 548 (antibiotic drugs for use with animals), and 558 (new animal drugs for use in animal feed). See Section 1.B of this document for relevant citations.

Formal tolerances are not established in all cases. For example, tolerance exemptions have been granted by FDA and EPA in approving the use of some pesticides and new animal drugs. For some unavoidable contamination situations, FDA and EPA, upon request, recommend action levels to FSIS; however, tolerances or action levels have not been established for all such situations. FSIS permits concentrations of residues in meat and poultry that do not exceed the residue limits published in this section.

The residue limits for poultry and livestock species are listed alphabetically by compound (which may include a compound's metabolites). The entries include, among other things, CFR or Federal Register (FR) citations for tolerances, and notations of action levels. Entries for animal drugs with "zero" or "no residue" tolerances also include, in parenthesis, the limits of quantification considered by FDA in approving uses of those drugs in food-producing animals. These limits are used by FDA for enforcement purposes, and are applied by FSIS in determining if product is adulterated.

Any residue of a new animal drug found in the edible tissues of a species for which the drug is not approved will be considered an adulterant, provided the residue is found at a concentration that can be quantified and confirmed by a validated analytical method. A concentration of a substance endogenous in the animal tissue in question would not be considered an adulterant.

Unless otherwise indicated, "meat byproducts" includes kidney and liver.

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats				Horses
			Swine	Poultry	Units are parts per million		
Acephate and metabolite	40 CFR 180.108	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	
2-Acetyl-amino-5-nitrothiazole	21 CFR 556.20	-	-	-	0.1Et ¹	-	
Acifluorfen and metabolites	40 CFR 180.383	0.02K 0.02L	0.02K 0.02L	0.02K 0.02L	0.02F 0.02M 0.02Mb	0.02K 0.02L	
Aklomide and metabolite	21 CFR 556.30	-	-	-	4.5L ² 4.5M ² 3St ²	-	
Alachlor and metabolites	40 CFR 180.249	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	
Albendazole	21 CFR 556.34	0.2L ³	-	-	-	-	
Aldicarb and metabolites	40 CFR 180.269	0.01F 0.01M 0.01Mb	0.01F 0.01M 0.01Mb	0.01F 0.01M 0.01Mb	-	0.01F 0.01M 0.01Mb	
Aldrin	51 FR 46662	0.3F ⁴	0.3F ⁴	0.3F ⁴	0.3F ⁴	0.3F ⁴	
Amitraz and metabolites	40 CFR 180.287 53 FR 18898	0.1F 0.05M 0.3Mb	0F 0M 0Mb	0.1F 0.05M 0.3Mb 0.2K 0.2L	- - -	F0 0M 0Mb	
Amoxicillin	21 CFR 556.38	0.01Et	-	-	-	-	
Ampicillin	21 CFR 556.40	0.01Et	-	0.01Et	-	-	

1 Turkeys only.

2 Chickens only.

3 Tolerance for marker residue, the 2-aminosulfone.

4 Action Level.

5 Tolerances established until August 30, 1991.

KEY

Ek: Excluding kidneys

Et: Edible tissue

F: Fat

K: Kidney

L: Liver

M: Muscle

Mb: Meat byproducts

S: Skin

St: Skin with fat

Sm: Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats		Swine	Poultry	Horses
			Units are parts per million				
Amprolium	21 CFR 556.50	2.0F ¹ 0.5K ¹ 0.5L ¹ 0.5M ¹	-	-	-	1K ² 1L ² 0.5M ²	-
Apramycin	21 CFR 556.52	-	-	0.4F ³ 0.4K ³ 0.3L ³ 0.1M ³	-	-	-
Arsenic	21 CFR 556.60	-	-	2K 2L 0.5M 0.5Mb	0.5M 2Mb	-	-
Arsenite (sodium) (as As ₂ O ₃)	40 CFR 180.335	0.7F 2.7K 2.7L 0.7M 0.7Mb	-	-	-	-	0.7F 2.7K 2.7L 0.7M 0.7Mb
Atrazine	40 CFR 180.220	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	0.02F 0.02F 0.02Mb	0.02F 0.02F 0.02Mb	0.02F 0.02M 0.02Mb
Avermectin ⁴	40 CFR 180.449 54 FR 31836	0.02M 0.02Mb	-	-	-	-	-
Bacitracin	21 CFR 556.70	0.5Et	-	0.5Et	0.5Et ⁵	-	-
Benomyl and metabolites	40 CFR 180.294	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.2L 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb
Bentazon and metabolite	40 CFR 180.355	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	-	-

1 Calves only.

2 Chickens and turkeys.

3 Total residues.

4 Tolerances (for residues resulting from use as a pesticide) established until March 31, 1993.

5 Also pheasant and quail.

KEY

Ek:Excluding kidneys

Et:Edible tissue

F:Fat

K:Kidney

L:Liver

M:Muscle

Mb:Meat byproducts

S:Skin

Sf:Skin with fat

Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
BHC	51 FR 25697	0.3F ¹	0.3F ¹	0.3F ¹	0.3F ¹	0.3F ¹
Bifenthrin ²	40 CFR 180.442	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	-	0.1F 0.1M 0.1Mb
Bromoxynil	40 CFR 180.324	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	-	0.1F 0.1M 0.1Mb
Buquinolate	21 CFR 556.90	-	-	-	0.4K ³ 0.4L ³ 0.1M ³ 0.4Sf ³	-
sec-Butylamine	40 CFR 180.321	0.75F 3K 0.75M 0.75Mb	-	-	-	-
Cacodylic acid (as As ₂ O ₃)	40 CFR 180.311	0.7F 1.4K 1.4L 0.7M 0.7Mb	-	-	-	-
Captan	40 CFR 180.103	0.05F 0.05M 0.05Mb	-	0.05F 0.05M 0.05Mb	-	-
Carbadox and metabolite	21 CFR 556.100	-	-	0(0.030)Et	-	-
Carbaryl and metabolites	40 CFR 180.169	0.1F 1K 1L 0.1M 0.1Mb	0.1F 1K 1L 0.1M 0.1Mb	0.1F 1K 1L 0.1M 0.1Mb	5F 5M	0.1F 1K 1L 0.1M 0.1Mb

1 Action level.

2 Tolerances established until October 31, 1992.

3 Chickens only.

KEY

Ek:Excluding kidneys

Et:Edible tissue

F:Fat

K:Kidney

L:Liver

M:Muscle

Mb:Meat byproducts

S:Skin

Sf:Skin with fat

Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
Carbofuran and metabolites ¹	40 CFR 180.254	0.05F	0.05F	0.05F	-	0.05F
		0.05M	0.05M	0.05M	-	0.05M
		0.05Mb	0.05Mb	0.05Mb	-	0.05Mb
Carbomycin	21 CFR 556.110	-	-	-	0(0.5)Et ²	-
Carbophenothion	40 CFR 180.156	0.1F	0.1F	0.1F	-	-
Carboxin and metabolite	40 CFR 180.301	0.1F	0.1F	0.1F	0.1F	0.1F
		0.1M	0.1M	0.1M	0.1M	0.1M
		0.1Mb	0.1Mb	0.1Mb	0.1Mb	0.1Mb
Ceftiofur	21 CFR 556.113	- ³				
Cephapirin	21 CFR 556.115	0.1Et	-	-	-	-
Chlordane	51 FR 46665	0.2F ⁴	0.2F ⁴	0.2F ⁴	0.2F ⁴	0.2F ⁴
Chlordimeform and metabolites	54 FR 43424	0.1F	0.1F	0.1F	0.1F	0.1F
		0.1M	0.1M	0.1M	0.1M	0.1M
		0.1Mb	0.1Mb	0.1Mb	0.1Mb	0.1Mb
Chlorhexidine	21 CFR 556.120	0(0.001)Et ⁵	-	-	-	-
2-Chloro-1-(2,4-dichlorophenyl) vinyl diethyl phosphate [chlorfenvinphos]	40 CFR 180.322	0.2F	0.2F ⁶	0.005F	0.005F	0.005F
2-Chloro-N-isopropylacetanilide [propachlor]	40 CFR 180.211	0.02F	0.02F	0.02F	0.02F	0.02F
		0.02M	0.02M	0.02M	0.02M	0.02M
		0.02Mb	0.02Mb	0.02Mb	0.02Mb	0.02Mb
Chloroneb and metabolite	40 CFR 180.257	0.2F	0.2F	0.2F		0.2F
		0.2M	0.2M	0.2M		0.2M
		0.2Mb	0.2Mb	0.2Mb		0.2Mb

1 No more than 0.02 can be carbamates.

2 Chickens only.

3 Tolerance for marker residue not needed.

4 Action level; includes sum of residues of cis- and trans-chlordane, cis- and trans-nonachlor, oxychlordane (octachlor epoxide), and alpha, beta, and gamma chlordene.

5 Calves only.

6 Sheep only; goats 0.005F.

KEY

Ek:Excluding kidneys

Et:Edible tissue

F:Fat

K:Kidney

L:Liver

M:Muscle

Mb:Meat byproducts

S:Skin

Sf:Skin with fat

Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
1-(4-Chlorophenoxy)- 3, 3-dimethyl-1- (1H-1, 2, 4-triazol-1-yl)- 2-butanone and metabolites [triademefon]	40 CFR 180.410	1.0F	1.0F	0.04F	0.04F	1.0F
		1.0M	1.0M	0.04M	0.04M	1.0M
		1.0Mb	1.0Mb	0.04Mb	0.04Mb	1.0Mb
2-(m-Chlorophenoxy) propionic acid [stirofos, tetrachlorovinphos]	40 CFR 180.325	0.05F	0.05F	0.05F	0.05F	0.05F
		0.5K	0.5K	0.5K		0.5K
		0.05M	0.05M	0.05M	0.05M	0.05M
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb
2-Chloro-1-(2, 4, 5- trichlorophenyl) vinyl dimethyl phosphate	40 CFR 180.252	1.5F	0.5F	1.5F	0.75F	0.5F
Chlorpyrifos and metabolite	40 CFR 180.342	2.0F	1.0F	0.5F	0.5F	1.0F
		2.0M	1.0M	0.5M	0.5M	1.0M
		2.0Mb	1.0Mb	0.5Mb	0.5Mb	1.0Mb
Chlorpyrifos- methyl and metabolite	40 CFR 180.419	0.5F	0.5F	0.5F	0.5F	0.5F
		0.5M	0.5M	0.5M	0.5M	0.5M
		0.5Mb	0.5Mb	0.5Mb	0.5Mb	0.5Mb
Chlorsulfuron	40 CFR 180.405	0.3F	0.3F	0.3F	-	0.3F
		0.3M	0.3M	0.3M		0.3M
		0.3Mb	0.3Mb	0.3Mb		0.3Mb
Chlortetracycline	21 CFR 556.150	0F ¹	-	0.2F	1F	-
		0.1K ¹	1K ²	4K	4K	
		0.1L ¹	0.5L ²	2L	1L	
		0.1M ¹	0.1M ²	1M	1M 1S	
Clopidol	21 CFR 556.160	3K	3K	0.2Et	15K	-
		1.5L	1.5L		15L	
		0.2M	0.2M		5M	
Clopyralid	40 CFR 180.431	1.0F	1.0F	0.2F	0.2F	1.0F
		12.0K	12.0K	-	-	12.0K
		1.0M	1.0M	0.2M	0.2M	1.0M
		1.0Mb	1.0Mb	0.2Mb	0.2Mb	1.0Mb

1 Cattle only; calves 1F, 4K,
4L, 1M.
2 Sheep only.

KEY

Ek:Excluding kidneys	M:Muscle
Et:Edible tissue	Mb:Meat byproducts
F:Fat	S:Skin
K:Kidney	Sf:Skin with fat
L:Liver	Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
Clorsulon	21 CFR 556.163	1.0K ¹	-	-	-	-
Cloxacillin	21 CFR 556.165	0.01Et	-	-	-	-
Coumaphos and oxygen analog	40 CFR 180.189	1F 1M 1Mb	1F 1M 1Mb	1F 1M 1Mb	1F 1M 1Mb	1F 1M 1Mb
Crufomate	40 CFR 180.295	1F 1M 1Mb	1F 1M 1Mb	-	-	-
Cyano (3-phenoxy-phenyl)methyl-4-chloro-a-(methyl-ethyl)benzeneacetate [fenvalerate]	40 CFR 180.379	1.5F 1.5M 1.5Mb	1.5F 1.5M 1.5Mb	1.5F 1.5M 1.5Mb	-	1.5F 1.5M 1.5Mb
Cyfluthrin	40 CFR 180.436	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	-	0.05F 0.05M 0.05Mb
Cyhalothrin ²	40 CFR 180.438	0.01F 0.01M 0.01Mb	0.01F 0.01M 0.01Mb	0.01F 0.01M 0.01Mb	-	0.01F 0.01M 0.01Mb
Cyhexatin and metabolites	40 CFR 180.144	0.2F 0.5K 0.5L 0.2M 0.2Mb	0.2F 0.5K 0.5L 0.2M 0.2Mb	0.2F 0.5K 0.5L 0.2M 0.2Mb	-	0.2F 0.5K 0.5L 0.2M 0.2Mb
Cypermethrin ³	40 CFR 180.418	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	-	0.05F 0.05M 0.05Mb
Cyromazine	40 CFR 180.414	-	-	-	0.05F ⁴ 0.05M ⁴ 0.05Mb ⁴	-

1 Tolerance for clorsulon corresponds to 3.0 total residues in kidney.

2 Tolerances established until August 30, 1991.

3 Tolerances established until July 1, 1993.

4 Chicken layer hens and breeder hens; tolerance for parent cyromazine; an additional tolerance of 0.05F, M, Mb exists for the metabolite, melamine.

KEY

Ek:Excluding kidneys

Et:Edible tissue

F:Fat

K:Kidney

L:Liver

M:Muscle

Mb:Meat byproducts

S:Skin

Sf:Skin with fat

Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
2, 4-D and metabolite	40 CFR 180.142	0.2F	0.2F	0.2F	0.05F	0.2F
		2K	2K	2K	0.05K	2K
		0.2M	0.2M	0.2M	0.05M	0.2M
		0.2Mb	0.2Mb	0.2Mb	0.05Mb	0.2Mb
Dalapon	40 CFR 180.150	0.2M	0.2M	0.2M	3Ek	-
		0.2Mb	0.2Mb	0.2Mb	9K	
Daminozide	40 CFR 180.246	0.2F	0.2F	0.2F	0.2F	0.2F
		0.2M	0.2M	0.2M	0.2M	0.2M
		0.2Mb	0.2Mb	0.2Mb	0.2Mb	0.2Mb
DDT and metabolites	51 FR 46658	5F ¹	5F ¹	5F ¹	5F ¹	5F ¹
Decoquinatate	21 CFR 556.170	2Et	2Et ²	-	2Et ³	-
		1Sm	1Sm ²		1Sm ³	
Dialifor and oxygen analog	40 CFR 180.326	0.15F	0.15F	-	0.05F	-
		0.15M	0.15M		0.05M	
		0.15Mb	0.15Mb		0.05Mb	
Diazinon	40 CFR 180.153	0.7F	0.7F ⁴	-	-	-
		0.7M	0.7M ⁴			
		0.7Mb	0.7Mb ⁴			
Dicamba and metabolite	40 CFR 180.227	0.2F	0.2F	0.2F	-	0.2F
		1.5K	1.5K	1.5K		1.5K
		1.5L	1.5L	1.5L		1.5L
		0.2M	0.2M	0.2M		0.2M
		0.2Mb	0.2Mb	0.2Mb		0.2Mb
3, 5-Dichloro-N-(1,1-dimethyl-2-propynyl)benzamide and metabolites [pronamide]	40 CFR 180.317	0.02F	0.02F	0.02F	0.02F	0.02F
		0.2K	0.2K	0.2K	0.2K	0.2K
		0.2L	0.2L	0.2L	0.2L	0.2L
		0.02M	0.02M	0.02M	0.02M	0.02M
		0.02Mb	0.02Mb	0.02Mb	0.02Mb	0.02Mb
1, 1-Dichloro-2, 2-bis(p-ethylphenyl) ethane [perthane]	40 CFR 180.139	0M	0M	0M	0M	0M

- 1 Action level.
- 2 Goats only.
- 3 Chickens only.
- 4 Sheep only.

KEY

Ek: Excluding kidneys	M: Muscle
Et: Edible tissue	Mb: Meat byproducts
F: Fat	S: Skin
K: Kidney	Sf: Skin with fat
L: Liver	Sm: Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats			Swine	Poultry	Horses
Units are parts per million								
1-[[2-(2,4-Dichloro-phenyl)-4-propyl-1, 3-dioxolan-2-yl]methyl]-1-H-1, 2, 4 triazole and metabolites [propiconazole]	40 CFR 180.434	0.1F	0.1F	0.1F	0.1F	0.1F	0.1F	
		2.0K5	2.0K5	2.0K5	2.0K5	0.2K	2.0K5	
		2.0L5	2.0L5	2.0L5	2.0L5	0.2L	2.0L5	
		0.1M	0.1M	0.1M	0.1M	0.1M	0.1M	
		0.1Mb	0.1Mb	0.1Mb	0.1Mb	0.1Mb	0.1Mb	
Dichlorvos	40 CFR 180.235 21 CFR 556.180	0.02F	0.02F	0.1F	0.05F	0.02F		
		0.02M	0.02M	0.1M	0.05M	0.02M		
		0.02Mb	0.02Mb	0.1Mb	0.05Mb	0.02Mb		
Dieldrin	51 FR 46662	0.3F ²	0.3F ²	0.3F ²	0.3F ²	0.3F ²		
O, O-Diethyl-O-(p-(methylsulfinyl)phenylphosphorothioate and metabolites [fensulfothion]	40 CFR 180.234	0.02F	0.02F	0.02F	-	0.02F		
		0.02M	0.02M	0.02M	-	0.02M		
		0.02Mb	0.02Mb	0.02Mb	-	0.02Mb		
Difenzoquat	40 CFR 180.369	0.05F	0.05F	0.05F	0.05F	0.05F		
		0.05M	0.05M	0.05M	0.05M	0.05M		
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb		
Diflubenzuron	40 CFR 180.377	0.05F	0.05F	0.05F	0.05F	0.05F		
		0.05M	0.05M	0.05M	0.05M	0.05M		
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb		
Dihydrostreptomycin	21 CFR 556.200	0(0.5)Et ^{3,4}	-	-	-	-		
Dimethipin	40 CFR 180.406	0.02F	0.02F	0.02F	-	0.02F		
		0.02M	0.02M	0.02M	-	0.02M		
		0.02Mb	0.02Mb	0.02Mb	-	0.02Mb		
Dimethoate and oxygen analog	40 CFR 180.204	0.02F	0.02F	0.02F	0.02F	0.02F		
		0.02M	0.02M	0.02M	0.02M	0.02M		
		0.02Mb	0.02Mb	0.02Mb	0.02Mb	0.02Mb		
O, O-Dimethyl S-[(4-oxo-1, 2, 3-benzotriazin-3(4H)-yl)methyl]phosphorodithioate [azinphosmethyl]	40 CFR 180.154	0.1F	0.1F	-	-	0.1F		
		0.1M	0.1M	-	-	0.1M		
		0.1Mb	0.1Mb	-	-	0.1Mb		

1 Tolerances established until June 21, 1991.

2 Action level.

3 Calves only.

4 Administrative tolerance in calves and cattle 2.0K.

KEY

Ek:Excluding kidneys

Et:Edible tissue

F:Fat

K:Kidney

L:Liver

M:Muscle

Mb:Meat byproducts

S:Skin

Sf:Skin with fat

Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats Swine Poultry Horses			
			Units are parts per million			
O, O-Dimethyl-O-p-(dimethylsulfamoyl) phenyl phosphorothioate and oxygen analog [famphur]	40 CFR 180.233	0.1F 0.1M 0.1Mb	-	-	-	-
Dimethyl phosphate of a-methyl-benzyl 3-hydroxy-cis-crotonate [crotoxyphos]	40 CFR 180.280	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	-	-
N, N-Dimethyl-piperidinium chloride	40 CFR 180.384	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb
3, 5-Dinitrobenzamide	21 CFR 556.220	-	-	-	0(0.020)Et ¹	-
Dioxathion	40 CFR 180.171	1F	1F	1F	-	1F
Diphenamid	40 CFR 180.230	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	-	0.05F 0.05M 0.05Mb
Diphenylamine	40 CFR 180.190	0M	0M	0M	0M	0M
Dipropyl isocinchomer-onate	40 CFR 180.143	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	-	0.1F 0.1M 0.1Mb
Diquat	40 CFR 180.226	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb
Diuron	40 CFR 180.106	1F 1M 1Mb	1F 1M 1Mb	1F 1M 1Mb	-	1F 1M 1Mb
Dodecachloroocta-hydro-1, 3, 4-metheno-2H-cyclo-buta(cd) pentalene [Mirex]	51 FR 45114	0.1F ²	0.1F ²	0.1F ²	0.1F ²	0.1F ²

1 Chickens only.

2 Action level.

KEY

Ek:Excluding kidneys

Et:Edible tissue

F:Fat

K:Kidney

L:Liver

M:Muscle

Mb:Meat byproducts

S:Skin

Sf:Skin with fat

Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
Dodine	40 CFR 180.172	0M	0M	0M	0M	0M
Endosulfan and metabolite	40 CFR 180.182	0.2F 0.2M 0.2Mb	0.2F 0.2M 0.2Mb	0.2F 0.2M 0.2Mb	-	0.2F 0.2M 0.2Mb
Endrin	MPI Dir 917.1	0.3F ¹	0.3F ¹	0.3F ¹	0.3F ¹	0.3F ¹
Erythromycin	21 CFR 556.230	0(0.3)Et	-	0.1Et	0.125Et	-
Estradiol benzoate	21 CFR 556.240	480F ² 360K ² 240L ² 120M ²	600F ³ 600K ³ 600L ³ 120M ³	-	-	-
Estradiol monopalmitate	21 CFR 556.250	-	-	-	0(0.002)Et ⁴	-
Ethalfuralin	40 CFR 180.416	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb
Ethephon	40 CFR 180.300	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	-	0.1F 0.1M 0.1Mb
Ethion and oxygen analog	40 CFR 180.173	2.5F 2.5M ⁵ 1.0Mb	0.2F 0.2M 0.2Mb	0.2F 0.2M 0.2Mb	0.2F 0.2M 0.2Mb	0.2F 0.2M 0.2Mb
Ethofumesate and metabolites	40 CFR 180.345	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	-	0.05F 0.05M 0.05Mb
Ethopabate	21 CFR 556.260	-	-	-	1.5K ⁶ 1.5L ⁶ 0.5M ⁶	-

- 1 Action level.
- 2 Heifers, steers, and calves (ppt); above concentrations naturally present.
- 3 Lambs only (ppt); above concentrations naturally present.
- 4 Chickens only.
- 5 Fat basis.
- 6 Chickens only.

KEY

Ek:Excluding kidneys	M:Muscle
Et:Edible tissue	Mb:Meat byproducts
F:Fat	S:Skin
K:Kidney	Sf:Skin with fat
L:Liver	Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
2-[1-(Ethoxyimino)-butyl]-5-[2-(ethylthio)-propyl]-3-hydroxy-2-cyclohexene-1-one and metabolites [sethoxydim]	40 CFR 180.412 55 FR 6639	0.2F	0.2F	0.2F	0.2F	0.2F
		0.2M	0.2M	0.2M	0.2M	0.2M
		0.2Mb	0.2Mb	0.2Mb	2.0Mb	0.2Mb
Ethoxyquin	21 CFR 172.140	5F	5F	5F	3F	5F
		-	-	-	3L	-
		0.5M	0.5M	0.5M	0.5M	0.5M
5-Ethoxy-3-(trichloromethyl)-1, 2, 4-thiadiazole and metabolite [etridazole]	40 CFR 180.370	0.10F	0.10F	0.10F	0.10F	0.10F
		0.10M	0.10M	0.10M	0.10M	0.10M
		0.10Mb	0.10Mb	0.10Mb	0.10Mb	0.10Mb
Ethyl 4, 4'-dichlorobenzilate [chlorobenzilate]	40 CFR 180.109	0.5F	0.5F1	-	-	-
		0.5M	0.5M1			
		0.5Mb	0.5Mb1			
Ethyl 3-methyl-4-(methylthio)phenyl (1-methylethyl)phosphoramidate [fenamiphos]	40 CFR 180.349	0.05F	0.05F	0.05F	-	0.05F
		0.05M	0.05M	0.05M		0.05M
		0.05Mb	0.05Mb	0.05Mb		0.05Mb
O-Ethyl-O-[4-(methylthio)phenyl]S-propyl phosphorodithioate and metabolites [suprofos]	40 CFR 180.374	0.1F	0.1F	0.1F	0.01F	0.1F
		0.1M	0.1M	0.1M	0.01M	0.1M
		0.1Mb	0.1Mb	0.1Mb	0.01Mb	0.1Mb
S-[2-(Ethylsulfinyl)-ethyl]O, O-dimethylphosphorothioate and metabolites [oxydemeton methyl]	40 CFR 180.330	0.01F	0.01F	0.01F	-	0.01F
			0.01M	0.01M	0.01M	0.01M
		0.01Mb	0.01Mb	0.01Mb		0.01Mb
Fenarimol	40 CFR 180.421	0.1F	0.1F	0.1F	0.01F	0.1F
		0.1K	0.1K	0.1K		0.1K
		0.1L	0.1L	0.1L		0.1L
		0.01M	0.01M	0.01M	0.01M	0.01M
		0.01Mb	0.01Mb	0.01Mb	0.01Mb	0.01Mb
Fenbendazole	21 CFR 556.275	0.8L ²	-	³	-	-
Fenprosalene	21 CFR 556.277	⁴	-	-	-	-

KEY

- 1 Sheep only.
 2 Tolerance for parent fenbendazole; corresponds to 10 ppm total residues in liver.
 3 Tolerance for marker residues not needed.
 4 Tolerance for marker residues not needed.

Ek: Excluding kidneys
 Et: Edible tissue
 F: Fat
 K: Kidney
 L: Liver
 M: Muscle
 Mb: Meat byproducts
 S: Skin
 Sf: Skin with fat
 Sm: Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
Fenridazon, potassium salt	40 CFR 180.423	0.05F	0.05F	0.05F	0.30F	0.05F
		1.0K	1.0K	1.0K		1.0K
		1.0L	1.0L	1.0L		1.0L
		0.05M	0.05M	0.05M	0.30M	0.05M
		0.05Mb	0.05Mb	0.05Mb	0.30Mb	0.05Mb
Fenthion and metabolites	40 CFR 180.214	0.1F	-	0.1F	0.1F	-
		0.1M		0.1M	0.1M	
		0.1Mb		0.1Mb	0.1Mb	
Fluazifop and butyl ester	40 CFR 180.411	0.05F	0.05F	0.05F	0.05F	0.05F
		0.05M	0.05M	0.05M	0.05M	0.05M
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb
Flucythrinate	40 CFR 180.400	1.0F	1.0F	1.0F	-	1.0F
		0.1M	0.1M	0.1M		0.1M
		0.1Mb	0.1Mb	0.1Mb		0.1Mb
Fluridone	40 CFR 180.420	0.05F	0.05F	0.05F	0.05F	0.05F
		0.1K	0.1K	0.1K	0.1K	0.1K
		0.1L	0.1L	0.1L	0.1L	0.1L
		0.05M	0.05M	0.05M	0.05M	0.05M
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb
Fluvalinate	40 CFR 180.427	0.01F	0.01F	0.01F	0.01F	0.01F
		0.01M	0.01M	0.01M	0.01M	0.01M
		0.01Mb	0.01Mb	0.01Mb	0.01Mb	0.01Mb
Fluzilazol ¹	53 FR 34513	0.10L	0.10L	0.10L	-	0.10L
		0.01M	0.01M	0.01M		0.01M
		0.01Mb	0.01Mb	0.01Mb		0.01Mb
Furazolidone	21 CFR 556.290	-	-	0(0.100)Et	-	-
Gentamicin sulfate	21 CFR 556.300	-	-	0.4F	0.1Et ²	-
				0.4K		
				0.3L		
				0.1M		
Glyphosate and metabolite	40 CFR 180.364	0.5K	0.5K	0.5K	0.5K	0.5K
		0.5L	0.5L	0.5L	0.5L	0.5L

1 Tolerances established until October 9, 1989.

2 Turkeys only.

KEY

Ek:Excluding kidneys	M:Muscle
Et:Edible tissue	Mb:Meat byproducts
F:Fat	S:Skin
K:Kidney	Sf:Skin with fat
L:Liver	Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats		Swine	Poultry	Horses
Units are parts per million							
Halofuginone	21 CFR 556.308 54 FR 28051	-	-	-	-	0.1L ¹	-
Haloxon	21 CFR 556.310	0.1Et	-	-	-	-	-
HCB	MPI Dir 917.1	0.5F ²	0.5F ²	0.5F ²	0.5F ²	0.5F ²	0.5F ²
Heptachlor and heptachlor epoxide	54 FR 33690 MPI Dir 917.1	0.2F ²	0.2F ²	0.2F ²	0.2F ²	0.2F ²	0.2F ²
		0.2M ²	0.2M ²	0.2M ²	0.2M ²	0.2M ²	0.2M ²
		0.2Mb ²	0.2Mb ²	0.2Mb ²	0.2Mb ²	0.2Mb ²	0.2Mb ²
Hexakis (2-methyl-2- phenylpropyl) distannoxane	40 CFR 180.362	0.5F	0.5F	0.5F	0.1F	0.5F	
		0.5M	0.5M	0.5M	0.1M	0.5M	
		0.5Mb	0.5Mb	0.5Mb	0.1Mb	0.5Mb	
Hexazinone and metabolite	40 CFR 180.396	0.1F	0.1F	0.1F	0.1F	0.1F	
		0.1M	0.1M	0.1M	0.1M	0.1M	
		0.1Mb	0.1Mb	0.1Mb	0.1Mb	0.1Mb	
Hygromycin B	21 CFR 556.330	-	-	0Et (0.9M) (1.4K)	0Et (0.9M) (1.4K)	-	
Imazalil and metabolites	40 CFR 180.413	0.01F	0.01F	0.01F	-	0.01F	
		0.50L	0.50L	0.50L	-	0.50L	
		0.01M	0.01M	0.01M	-	0.01M	
		0.01Mb	0.01Mb	0.01Mb	-	0.01Mb	
Iprodione and metabolites	40 CFR 180.399 54 FR 31832	0.5F	0.5F	0.5F	3.5F	0.5F	
		3.0K	3.0K	3.0K	-	3.0K	
		3.0L	3.0L	3.0L	5.0L	3.0L	
		0.5M	0.5M	0.5M	0.5M	0.5M	
		0.5Mb	0.5Mb	0.5Mb	1.0Mb	0.5Mb	
Isopropyl carbanilate [IPC, isopropocarb]	40 CFR 180.319 ³	0.05F	0.05F	0.05F	0.05F	0.05F	
		0.05M	0.05M	0.05M	0.05M	0.05M	
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb	

1 Broiler chickens and turkeys;
tolerance for parent
halofuginone; corresponds to
0.3 ppm total residues in liver
2 Action level.
3 Interim tolerance.

KEY

Ek:Excluding kidneys
Et:Edible tissue
F:Fat
K:Kidney
L:Liver
M:Muscle
Mb:Meat byproducts
S:Skin
Sf:Skin with fat
Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
Isopropyl m-chloro-carbanilate [CIPC, chlorpropham]	40 CFR 180.319 ¹	0.05F	0.05F	0.05F	0.05F	0.05F
		0.05M	0.05M	0.05M	0.05M	0.05M
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb
Ivermectin	21 CFR 556.344	15L ²	30L ³	20L ⁴	-	-
Lasalocid	21 CFR 556.347	0.7L ⁵	- ⁶	-	0.3Sf ⁷	-
Levamisole	21 CFR 556.350	0.1Et	0.1Et ⁸	0.1Et	-	-
Lincomycin	21 CFR 556.360 55 FR 3208	-	-	0.1Et	-	-
Lindane	40 CFR 180.133 MPI Dir. 917.1	7F	7F	4F	4F ⁹	7F
Linuron	40 CFR 180.184	1F	1F	1F	-	1F
		1M	1M	1M	-	1M
		1Mb	1Mb	1Mb	-	1Mb
Maduramicin	21 CFR 556.375	-	-	-	0.38F ¹⁰	-
Malathion	40 CFR 180.111	4F	4F	4F	4F	4F
		4M	4M	4M	4M	4M
		4Mb	4Mb	4Mb	4Mb	4Mb
Melengestrol acetate	21 CFR 556.380	0(0.025)Et	-	-	-	-

1 Interim tolerance.

2 Tolerance in ppb for 22, 23 dihydroavermectin B1a; corresponds to 50 ppb total residues in liver.

3 Sheep only; tolerance in ppb for 22, 23 dihydroavermectin B1a; corresponds to 125 ppb total residues in liver.

4 Tolerance in ppb for 22, 23-dihydroavermectin B1a; corresponds to 75 ppb total residues in liver.

5 Tolerance for parent lasalocid; corresponds to 4.8 total residues in liver.

6 Tolerance for marker residue not needed. Sheep only.

7 Chickens only; tolerance for parent lasalocid; corresponds to 7.2 total residues in liver.

8 Sheep only.

9 Action level.

10 Chickens only; tolerance for marker residue.

KEY

Ek:Excluding kidneys	M:Muscle
Et:Edible tissue	Mb:Meat byproducts
F:Fat	S:Skin
K:Kidney	Sf:Skin with fat
L:Liver	Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
N-(Mercaptomethyl) phthalimide S-(O, O-dimethyl phosphorodithioate) and oxygen analog [phosmet]	40 CFR 180.261	0.2F	0.2F	0.2F	-	0.2F
		0.2M	0.2M	0.2M		0.2M
		0.2Mb	0.2Mb	0.2Mb		0.2Mb
Metalaxyl and metabolites	40 CFR 180.408	0.4F	0.4F	0.4F	0.4F	0.4F
		0.4K	0.4K	0.4K	0.4K	0.4K
		0.4L	0.4L	0.4L	0.4L	0.4L
		0.05M	0.05M	0.05M	0.05M	0.05M
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb
Methidathion	40 CFR 180.298	0.05F	0.05F	0.05F	0.05F	0.05F
		0.05M	0.05M	0.05M	0.05M	0.05M
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb
Methoprene	40 CFR 180.359	0.3F	0.3F	0.3F	0.5F	0.3F
		0.1M	0.1M	0.1M	0.5M	0.1M
		0.1Mb	0.1Mb	0.1Mb	0.05Mb	0.1Mb
Methoxychlor	40 CFR 180.120 MPI Dir. 917.1	3F	3F	3F	3F ¹	3F
2-Methyl-4-chloro-phenoxy acetic acid and metabolite [MCPA]	40 CFR 180.339	0.1F	0.1F	0.1F	-	0.1F
		0.1M	0.1M	0.1M		0.1M
		0.1Mb	0.1Mb	0.1Mb		0.1Mb
6-Methyl-1, 3-dithiolo (4, 5-b)quinoxalin-2-one [oxythioquinox]	40 CFR 180.338	0.05F	0.05F	0.05F	-	0.05F
		0.05M	0.05M	0.05M		0.05M
		0.05Mb	0.05Mb	0.05Mb		0.05Mb
1-Methylethyl-2-((ethoxy ((1-methylethyl)amino)phosphinothioyl)oxy)benzoate and metabolites [isofenphos]	40 CFR 180.387	0.1F	0.1F	0.1F	0.1F	0.1F
		0.1M	0.1M	0.1M	0.1M	0.1M
		0.1Mb	0.1Mb	0.1Mb	0.1Mb	0.1Mb
Metolachlor and metabolites	40 CFR 180.368	0.02F	0.02F	0.02F	0.02F	0.02F
		0.2K	0.2K	0.2K	-	0.2K
		0.05L	0.05L	0.05L	0.05L	0.05L
		0.02M	0.02M	0.02M	0.02M	0.02M
		0.02Mb	0.02Mb	0.02Mb	0.02Mb	0.02Mb

1 Action level.

KEY

- | | |
|----------------------|--------------------|
| Ek:Excluding kidneys | M:Muscle |
| Et:Edible tissue | Mb:Meat byproducts |
| F:Fat | S:Skin |
| K:Kidney | Sf:Skin with fat |
| L:Liver | Sm:Skeletal muscle |

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
Metoserpate hydrochloride	21 CFR 556.410	-	-	-	0.02Et ¹	-
Metribuzin	40 CFR 180.332	0.7F	0.7F	0.7F	0.7F	0.7F
		0.7M	0.7M	0.7M	0.7M	0.7M
		0.7Mb	0.7Mb	0.7Mb	0.7Mb	0.7Mb
Metsulfuron methyl	40 CFR 180.428	0.1F	0.1F	0.1F	-	0.1F
		0.1M	0.1M	0.1M	-	0.1M
		0.1Mb	0.1Mb	0.1Mb	-	0.1Mb
Monensin	21 CFR 556.420 54 FR 32633	0.05Et	0.05Et ²	-	. ³	-
Morantel tartrate	21 CFR 556.425	0.70L ⁴	-	-	-	-
Myclobutanil	40 CFR 180.443	0.05F	0.05F	0.05F	0.02F	0.05F
		0.3L	0.3L	0.3L	-	0.3L
		0.05M	0.05M	0.05M	0.02M	0.05M
		0.05Mb	0.05Mb	0.05Mb	0.02Mb	0.05Mb
Naled and metabolite	40 CFR 180.215	0.05F	0.05F	0.05F	0.05F	0.05F
		0.05M	0.05M	0.05M	0.05M	0.05M
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb
Narasin	21 CFR 556.428	-	-	-	. ⁵	-
Neomycin	21 CFR 556.430	0.25Et ⁶	-	-	-	-
		1.00F ⁷	1.25F ⁷	1.00F ⁷	0.50F ⁷	-
		0.75K ⁷	1.25K ⁷	1.00K ⁷	1.00K ⁷	-
		0.50L ⁷	1.25L ⁷	0.75L ⁷	0.75L ⁷	-
		0.25M ⁷	0.25M ⁷	0.25M ⁷	0.25M ⁷	0.25M ⁷

1 Chickens only.

2 Goats only.

3 Chickens, turkeys, and quail; tolerance for marker residue not needed.

4 Tolerance for marker residue N-methyl-1,3-propanediamine (MAPA); corresponds to 2.40 ppm total residues in liver.

5 Chickens only; tolerance not needed.

6 Calves only.

7 Action level (letter from J. Taylor of FDA to L. Crawford of FSIS, January 26, 1988).

KEY

Ek: Excluding kidneys

M: Muscle

Et: Edible tissue

Mb: Meat byproducts

F: Fat

S: Skin

K: Kidney

Sf: Skin with fat

L: Liver

Sm: Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
Nequinatate	21 CFR 556.440	-	-	-	0.1Et ¹	-
Nicarbazin	21 CFR 556.445	-	-	-	4K ¹ 4L ¹ 4M ¹ 4S ¹	-
Nicotine	40 CFR 180.167a	-	-	-	1F 1M 1Mb	-
Nitrapyrin and metabolite	40 CFR 180.350	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb
Norflurazon	40 CFR 180.356	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb	0.1F 0.1M 0.1Mb
Novobiocin	21 CFR 556.460	1Et	-	-	1Et	-
Nystatin	21 CFR 556.470	-	-	0(5.6)Et	0(5.6)Et	-
N-Octyl bicycloheptenedicarboximide	40 CFR 180.367	0.3F	0.3F	0.3F	-	0.3F
Oleandomycin	21 CFR 556.480	-	-	0.15Et	0.15Et	-
Ormetoprim	21 CFR 556.490	-	-	-	0.1Et	-
Oxadiazon and metabolites	40 CFR 180.346	0.01F 0.01M 0.01Mb	0.01F 0.01M 0.01Mb	0.01F 0.01M 0.01Mb	-	0.01F 0.01M 0.01Mb
Oxyfluorfen and metabolites	40 CFR 180.381	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb

¹ Chickens only.

KEY

Ek:Excluding kidneys	M:Muscle
Et:Edible tissue	Mb:Meat byproducts
F:Fat	S:Skin
K:Kidney	Sf:Skin with fat
L:Liver	Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
Oxytetracycline	21 CFR 556.500	0.1Et	-	0.1Et	1F 3K 1L 1M 1S	-
Paraquat	40 CFR 180.205	0.05F 0.3K 0.05M 0.05Mb	0.05F 0.3K 0.05M 0.05Mb	0.05F 0.3K 0.05M 0.05Mb	0.01F - 0.01M 0.01Mb	0.05F 0.3K 0.05M 0.05Mb
PCB's ¹	21 CFR 109.30 46 FR 39224	3F ²	3F ²	3F ²	3F?	3F ²
Penicillin	21 CFR 556.510	0.05Et	0(0.04)Et	0(0.04)Et	0(0.04)Et ³	-
Permethrin and metabolites ⁴	40 CFR 180.378	3.0F 0.25M 2.0Mb	3.0F 0.25M 2.0Mb	3.0F 0.12M 3.0Mb	0.15F 0.05M 0.25Mb	3.0F 0.25M 2.0Mb
Phenothiazine	40 CFR 180.319 ⁵	2F 2M 2Mb	-	-	-	-
Phorate and metabolites	40 CFR 180.206	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb	0.05F 0.05M 0.05Mb
Phosalone	40 CFR 180.263	0.25F 0.25M 0.25Mb	0.25F 0.25M 0.25Mb	0.25F 0.25M 0.25Mb	-	0.25F 0.25M 0.25Mb
Picloram	40 CFR 180.292	0.2F 5K 0.5L 0.2M 0.2Mb	0.2F 5K 0.5L 0.2M 0.2Mb	0.2F 5K 0.5L 0.2M 0.2Mb	0.05F 0.05M 0.05Mb	0.2F 5K 0.5L 0.2M 0.2Mb

1 The temporary tolerances for unavoidable residues of PCB's in infant and junior foods are 0.2 ppm and 3 ppm, respectively [21 CFR 109.30(a)(3,8)].

2 Action level.

3 Chickens, pheasants, and quail; turkeys 0.01Et; ducks and geese 0.01Et (action level).

4 All units are parts per billion.

5 Interim tolerance.

KEY

Ek: Excluding kidneys

Et: Edible tissue

F: Fat

K: Kidney

L: Liver

M: Muscle

Mb: Meat byproducts

S: Skin

Sf: Skin with fat

Sm: Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
Piperonyl butoxide	40 CFR 180.127	0.1F	0.1F	0.1F	3F	0.1F
		0.1M	0.1M	0.1M	3M	0.1M
		0.1Mb	0.1Mb	0.1Mb	3Mb	0.1Mb
Pirimiphos-methyl and metabolites	40 CFR 180.409	0.2F	0.2F	0.2F	0.2F	0.2F
		2.0K	2.0K	2.0K	-	2.0K
		2.0L	2.0L	2.0L	-	2.0L
		0.2M	0.2M	0.2M	2.0M	0.2M
		0.2Mb	0.2Mb	0.2Mb	2.0Mb	0.2Mb
Profenofos and metabolites	40 CFR 180.404	0.05F	0.05F	0.05F	0.05F	0.05F
		0.05M	0.05M	0.05M	0.05M	0.05M
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb
Profluralin	40 CFR 180.348	0.02F	0.02F	0.02F	0.02F	0.02F
		0.02M	0.02M	0.02M	0.02M	0.02M
		0.02Mb	0.02Mb	0.02Mb	0.02Mb	0.02Mb
Progesterone	21 CFR 556.540	12F ¹	15F ²	-	-	-
		9K ¹	15K ²	-	-	-
		6L ¹	15L ²	-	-	-
		3M ¹	3M ²	-	-	-
Propanil and metabolites	40 CFR 180.274	0.1F	0.1F	0.1F	0.1F	0.1F
		0.1M	0.1M	0.1M	0.1M	0.1M
		0.1Mb	0.1Mb	0.1Mb	0.1Mb	0.1Mb
Propargite	40 CFR 180.259	0.1F	0.1F	0.1F	0.1F	0.1F
		0.1M	0.1M	0.1M	0.1M	0.1M
		0.1Mb	0.1Mb	0.1Mb	0.1Mb	0.1Mb
Pyrantel tartrate	21 CFR 556.560	-	-	10K	-	-
				10L		
				1M		
Pyrethrins	40 CFR 180.128	0.1F	0.1F	0.1F	0.2F	0.1F
		0.1M	0.1M	0.1M	0.2M	0.1M
		0.1Mb	0.1Mb	0.1Mb	0.2Mb	0.1Mb
Quizalofop ethyl and metabolites	40 CFR 180.441	0.05F	0.05F	0.05F	0.05F	0.05F
		0.02M	0.02M	0.02M	0.02M	0.02M
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb

1 Steers and calves (ppb); above concentrations naturally present.
2 Lambs (ppb); above concentrations naturally present.

KEY

Ek: Excluding kidneys
Et: Edible tissue
F: Fat
K: Kidney
L: Liver
M: Muscle
Mb: Meat byproducts
S: Skin
Sf: Skin with fat
Sm: Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
Robenidine hydrochloride	21 CFR 556.580	-	-	-	0.2F ¹ 0.2S ¹ 0.1Et ²	-
Ronnel and metabolites	40 CFR 180.177	10F 4M 4Mb	10F 4M 4Mb	3F 2M 2Mb	0.01F 0.01M 0.01Mb	-
Simazine	40 CFR 180.213	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb	0.02F 0.02M 0.02Mb
Spectinomycin	21 CFR 556.600	-	-	-	0.1Et ¹	-
Streptomycin	21 CFR 556.610	- ³	-	0(0.5)Et	0(0.5)Et	-
Sulfabromo-methazine	21 CFR 556.620	0.1Et	-	-	-	-
Sulfachloropyrazine	21 CFR 556.625	-	-	-	0(0.1)Et ¹	-
Sulfachlorpyridazine	21 CFR 556.630	0.1Et ⁴	-	0.1Et	-	-
Sulfadimethoxine	21 CFR 556.640	0.1Et	-	-	0.1Et	-
Sulfaethoxy-pyridazine	21 CFR 556.650 MPI Dir. 917.1	0.1Et	-	0(0.1)Et	0.1Et ^{5,6}	-
Sulfamethazine	21 CFR 556.670	0.1Et	-	0.1Et	0.1Et ¹	-
Sulfanitran and metabolites	21 CFR 556.680	-	-	-	0(0.1)Et ²	-
Sulfathiazole	21 CFR 556.690	-	-	0.1Et	-	-
Sulfomyxin	21 CFR 556.700	-	-	-	0(0.1)Et	-
Tebuthiuron and metabolites	40 CFR 180.390	2F 2M 2Mb	2F 2M 2Mb	-	-	2F 2M 2Mb

- 1 Chickens only.
- 2 Other than fat or skin (chickens only).
- 3 Administrative tolerance 2.0K.
- 4 Calves only.
- 5 Action level.
- 6 Turkeys only.

KEY

- Ek:Excluding kidneys
- Et:Edible tissue
- F:Fat
- K:Kidney
- L:Liver
- M:Muscle
- Mb:Meat byproducts
- S:Skin
- Sf:Skin with fat
- Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
Terbacil and metabolites	40 CFR 180.209	0.1F	0.1F	0.1F	-	0.1F
		0.1M	0.1M	0.1M		0.1M
		0.1Mb	0.1Mb	0.1Mb		0.1Mb
Testosterone propionate	21 CFR 556.710	2.6F ³	-	-	-	-
		1.9K ³				
		1.3L ³				
		0.64M ³				
Tetracycline	21 CFR 556.720	0.25Et ⁴	0.25Et	0.25Et	0.25Et	-
Tetradifon	40 CFR 180.174	0M	0M	0M	0M	0M
Thiabendazole and metabolite	21 CFR 556.730 40 CFR 180.242	0.1Et	0.1Et	0.1Et	-	0.1Et
		0.1F	0.1F	0.1F	0.1F	0.1F
		0.1M	0.1M	0.1M	0.1M	0.1M
		0.1Mb	0.1Mb	0.1Mb	0.1Mb	0.1Mb
Thidiazuron and metabolites	40 CFR 180.403	0.2F	0.2F	0.2F	0.2F	0.2F
		0.2M	0.2M	0.2M	0.2M	0.2M
		0.2Mb	0.2Mb	0.2Mb	0.2Mb	0.2Mb
Thiobencarb and metabolites	40 CFR 180.401	0.2F	0.2F	0.2F	0.2F	0.2F
		0.2M	0.2M	0.2M	0.2M	0.2M
		0.2Mb	0.2Mb	0.2Mb	0.2Mb	0.2Mb
Thiophanate-methyl and metabolites	40 CFR 180.371	0.1F	0.1F	0.1F	0.1F	0.1F
		0.2K	0.2K	1.0L	0.2L	1.0L
		2.5L	2.5L	0.1M	0.1M	0.1M
		0.1M	0.1M	0.1Mb	0.1Mb	0.1Mb
		0.1Mb	0.1Mb	0.05Mb		0.05Mb
Tiamulin	21 CFR 556.738	-	-	0.4L ⁵	-	-
Toxaphene	40 CFR 180.138 MPI Dir. 917.1	7F	7F	7F	7F ⁶	7F

- 1 Chickens and turkeys only.
- 2 Chickens only.
- 3 Heifers only, (ppb) above concentrations naturally present
- 4 Calves only.
- 5 Tolerance for 8-a-hydroxymutilin; corresponds to 10.8 total residues in liver.
- 6 Action level.

KEY

- Ek: Excluding kidneys
- Et: Edible tissue
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- K: Kidney
- L: Liver
- M: Muscle
- Mb: Meat byproducts
- S: Skin
- Sf: Skin with fat
- Sm: Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
			Units are parts per million			
Trenbolone	21 CFR 556.739	- ¹	-	-	-	-
Triasulfuron ²	55 FR 49422	0.05F	0.05F	0.05F	-	0.05F
		0.5K	0.5K	0.5K	-	0.5K
		0.1L	0.1L	0.1L	-	0.1L
		0.05M	0.05M	0.05M	-	0.05M
		0.05Mb	0.05Mb	0.05Mb	0.05Mb	0.05Mb
S, S, S-Tributyl-phospho-trithioate	40 CFR 180.272	0.02F	0.02F	-	-	-
		0.02M	0.02M	-	-	-
		0.02Mb	0.02Mb	-	-	-
Trichlorfon	40 CFR 180.198	0.1F	0.1F	-	-	0.1F
		0.1M	0.1M	-	-	0.1M
		0.1Mb	0.1Mb	-	-	0.1Mb
Triclopyr and metabolites	40 CFR 180.417	0.05F	0.05F	0.05F	0.2F ³	0.05F
		0.5K	0.5K	0.5K	1.0K ³	0.5K
		0.5L	0.5L	0.5L	0.2L ³	0.5L
		0.05M	0.05M	0.05M	0.2M ³	0.05M
		0.05Mb	0.05Mb	0.05Mb	0.2Mb ³	0.05Mb
Triphenyltin hydroxide	40 CFR 180.236	0.05K	0.05K	0.05K	-	0.05K
		0.05L	0.05L	0.05L	-	0.05L
Tylosin	21 CFR 556.740	0.2F	-	0.2F	0.2F	-
		0.2K	-	0.2K	0.2K	-
		0.2L	-	0.2L	0.2L	-
		0.2M	-	0.2M	0.2M	-
Virginiamycin	21 CFR 556.750	-	-	0.4F	0.2F ⁴	-
		-	-	0.4K	0.5K ⁴	-
		-	-	0.3L	0.3L ⁴	-
		-	-	0.1M	0.1M ⁴	-
		-	-	0.4S	0.2S ⁴	-

1 Tolerance not needed.

2 Tolerances established until December 31, 1991

3 Tolerances established until July 11, 1990.

4 Broiler chickens only.

KEY

Ek:Excluding kidneys

Et:Edible tissue

F:Fat

K:Kidney

L:Liver

M:Muscle

Mb:Meat byproducts

S:Skin

Sf:Skin with fat

Sm:Skeletal muscle

1991 RESIDUE LIMITS

Compound	Reference	Cattle	Sheep/ Goats	Swine	Poultry	Horses
Zeranol	21 CFR 556.760	150M ¹ 300L ¹ 450K ¹ 600F ¹	0(0.020)Et ²	-	-	-
Zinc ion & maneb, coordination product [mancozeb]	40 CFR 180.176	0.5K 0.5L	0.5K 0.5L	0.5K 0.5L	0.5K 0.5L	0.5K 0.5L
Zoalene and metabolite	21 CFR 556.770	-	-	-	2F ³ 6K ³ 6L ³ 3M ³	-

1 Residue limits (ppb) (FSIS Policy Letter, McDougall, Nov. 8, 1990).

2 Sheep only.

3 Chickens only; turkeys: 3L, 3M.

KEY

Ek:Excluding kidneys

Et:Edible tissue

F:Fat

K:Kidney

L:Liver

M:Muscle

Mb:Meat byproducts

S:Skin

Sf:Skin with fat

Sm:Skeletal muscle

Section 3

FSIS RESIDUE ANALYTICAL CAPABILITY

Introduction

The Food Safety and Inspection Service (FSIS) requires practical analytical methods for detecting, quantifying, and identifying all residues that may be present in meat, poultry, and their processed products at levels above established safe residue limits. These methods can be used by the Agency for monitoring and surveillance activities to determine whether product is adulterated. The Agency uses available methodology to take appropriate regulatory action against adulterated products, consistent with the reliability of the analytical data. However, because of the large number of potential residues that may occur in the food chain, practical methods are not available for many compounds of interest. This section describes the types of methods used by FSIS to conduct analyses and their suitability for regulatory use. A list of key terms precedes the method descriptions.

Method Levels

Methods are described in terms of levels of use:

Level I--These are assays with the highest level of credibility. They are unequivocal at the level of interest. They may be single procedures that determine both the concentration and the identity of the analyte, or combinations of determinative methods for concentration and confirmatory methods for definitive identification.

Level II--These are assays that are not unequivocal but are used to determine the concentration of an analyte at the level of interest and to provide some structural information. These methods are reliable enough to be used as reference methods.

Level III--These are screening methods that may generate limited though useful information. These tests detect the presence or absence of a compound or a class of compounds at some concentration level of interest. They are used because of a greater throughput, portability, or convenience than the Level I or Level II methods. The level of reliability has been determined and documented. The hallmark of Level III tests is that action based on individual positive results requires substantiation based on Level I or Level II methods, as required by the uncertainty of any individual results.

Methods are further classified according to their status. Within each classification, subgroups are defined according to the extent to which a method was subjected to study. Therefore, whether (or how well) a specific analytical method meets a defined suitability criterion determines its classification and subgroup.

Criteria for Practical Methods

The following criteria have been identified as guidelines for methods suitable for regulatory use.

1. The method requires no more than 2-4 hours of analytical time per sample.
2. The method requires no instrumentation not customarily available in a laboratory devoted to trace drug or environmental analysis.
3. Chemical methods have a Minimum Proficiency Level (MPL) at or below the established residue limit and antimicrobial methods have a Minimum Inhibitory Concentration (MIC) at or below the established residue limit.
4. A quality assurance plan (QAP) has been developed for the method.

FSIS RESIDUE ANALYTICAL CAPABILITY

5. The method has been subjected successfully to an interlaboratory study at 0, 1/2 X, X, and 2X, where X is the analyte concentration at the residue limit. FSIS considers the methods described for "zero tolerance" compounds to be suitable for regulatory use if they meet the suitability criteria listed above and have an MPL or MIC at the operational definition of zero defined by FDA or EPA. Methods determined to be suitable for regulatory use except for criterion 3 or 5 will be marked with an asterisk (*). In an emergency situation, exceptions to a method's suitability may be necessary.

Method Status

The method status classifications are:

A. AOAC Official Methods. Such methods have been subjected to an interlaboratory study in which five or more laboratories participated. If this collaborative process provides results that establish acceptability, the methods are accepted as official methods by the AOAC. Some AOAC official methods have been subsequently studied for extension as follows:

1. Extension to other analytes, tissues, species, and products by a three-analyst (two or three laboratory) study--a validation study.
2. Extension by a one or two analyst intralaboratory or interlaboratory study as follows:
 - a. Extended to other tissues, species, and products for the initial analyte(s) studied.
 - b. Extended to other similar analytes in the same matrices as initially studied.

B. Validated Methods. Methods subjected to an interlaboratory study in two or three laboratories with a minimum of three independent analysts. The resulting data are reviewed by a peer group of government scientists. The data that result from the study are made available for review upon request. Included in this category would be post-1973 New Animal Drug Application (NADA) methods developed by sponsors that have been successfully studied by FSIS and FDA laboratories. Some validated methods have been subsequently studied for extension by a single or two analyst intralaboratory or interlaboratory study as follows:

1. Extended to other tissues, species, and products for the initial analyte(s) studied.
2. Extended to other similar analytes for the initial tissues/species and products studied.

C. Federal Register Methods. Methods of analysis published in the Federal Register and later incorporated into the Code of Federal Regulations.

D. Historical Official Methods. Methods that were considered to be the best available at the time of initial acceptance and have continued in use over an extended period in the absence of a more effective method. Included in this category would be pre-1974 NADA methods that were submitted by sponsors and accepted by FDA and FSIS without a multilaboratory study.

E. Nonvalidated Methods (NVM). Methods for quantification and/or confirmation that have not been subjected to a multilaboratory study of at least three independent analysts; or, analytical methods that have been subjected to a multilaboratory study but do not meet either criterion 3 or 5 of the criteria for methods suitable for routine use.

FSIS RESIDUE ANALYTICAL CAPABILITY

F. Published Methods. These methods have been subjected to a study by a single analyst or laboratory when the data for evaluation are limited. However, a quality control plan will be in place. The results are reviewed by a peer group of government scientists.

G. Correlated Methods. These methods have not been validated by traditional interlaboratory study, but data obtained from use of the method have been correlated and/or compared with data obtained from use of a method for regulatory enforcement. The same samples must be used for this comparison, and the data must be reviewed by a peer group of government scientists.

FSIS RESIDUE ANALYTICAL CAPABILITY

KEY TERMS

AAS -- Atomic absorption spectrometry

AOAC -- Association of Official Analytical Chemists

CELIA CA -- Competitive Enzyme Labeled Immunoassay for Chloramphenicol: a laboratory test that detects and identifies chloramphenicol residues in cattle and pork muscle

EC -- Electron capture

EI -- Electron impact

E-Z Screen -- A proprietary immunoassay system for rapidly detecting and identifying various antibiotics and other residues in tissue extracts

GC -- Gas chromatography

GLC -- Gas liquid chromatography

GPC -- Gel permeation chromatography

HFB -- heptafluorobutyl[imidazole]

HPLC -- High pressure liquid chromatography

JAOAC -- Journal of the Association of Official Analytical Chemists

J. Food Prot. -- Journal of Food Protection

LDL -- Lowest detectable limit: the smallest amount of individual residue or sample component that can be reliably observed or found in the sample matrix by the current appropriate methodology

Method Status -- See discussion above

MIC -- Minimum inhibitory concentration: the minimum level of antimicrobial compound present in a buffer extract of tissue that will inhibit bacterial growth

MPL -- Minimum proficiency level: the minimum amount of analyte expected to be identified and quantified by a laboratory and upon which ongoing capability will be evaluated. It is the smallest concentration for which the predicted coefficient of variation for reproducibility (CV) is less than or equal to 20 percent and the upper 90 percent confidence level for the predicted CV is less than 30 percent.

MS -- Mass spectrometry

NADA -- New Animal Drug Application, issued by the Food and Drug Administration (FDA)

NE -- Level not established

FSIS RESIDUE ANALYTICAL CAPABILITY

KEY TERMS

NICI -- Negative ion chemical ionization

PICI -- Positive ion chemical ionization

PP -- Processed product

Quantification -- The determination of the amount of residue present in a sample

Reference Methods -- Analytical procedures by which other methods may be evaluated and for which performance standards are established. These methods are considered suitable for regulatory use in the National Residue Monitoring Program.

Residue -- Any compound present in edible tissues of the target animal that results from that compound's use or inadvertent introduction into the animal. "Residue" includes the compound itself, its metabolites, and other substances formed in or on food because of the compound's use or inadvertent introduction.

SOS -- Sulfa-on-Site: a rapid in-plant chemical screening test for detecting sulfonamide residues in food animal urine or serum that provides same-day results

STOP -- Swab Test on Premises: an overnight in-plant microbiological screen test for detecting antibiotic residues in edible tissues

Swab -- STOP precursor: an overnight laboratory microbiological screen test for detecting antibiotic residues in edible tissues

TLC -- Thin layer chromatography

UV -- Ultraviolet spectrophotometric technique for detection and quantification

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD		Species/ Tissues	Reference
			MPL	Level/ Status		
Albendazole (amino sulfone metabolite)	Marker residue detected and quantified by HPLC- fluorescence detection	20 ppb	50	IIB	Cattle/liver	Sec. 5.034 FSIS Chemistry Lab Guidebook
			ppb	IIB-1	Cattle/muscle Sheep/muscle liver	
			ppb	IB	Cattle/liver	
Aldicarb and metabolites	Extracts from HPLC confirmed by GC-MS	20 ppb	50	IB-1	Cattle/muscle Sheep/muscle liver	Sec. 5.034 FSIS Chemistry Lab Guidebook
			ppb			
			ppb			
Aldrin	Extraction with organic solvents followed by HPLC with UV detection; extracts confirmed by GC/EI/MS	0.05 ppm	NE	IIE IE	Red meat liver muscle	Copy available upon request
			ppb			
			ppb			
Aldrin	Micro alumina assay: column chromatography plus GLC	0.02 ppm	10	IIE IE	All/liver	Copy available upon request
			ppb			
			ppb			
Aldrin	GPC plus GLC	0.02 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook
			ppm			
			ppm			
Aldrin	Mills method: Florisil column chromatography plus GLC	0.02 ppm	0.05	IIA	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook
			ppm			
			ppm			

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Aldrin, continued	Extracts from GPC or Mills confirmed by GC/MS	0.03 ppm	NE	IE (GPC/MS) IF (Mills/MS)	All/fat pp	Sec. 5.004 FSIS Chemistry Lab Guidebook	
Amoxicillin trihydrate	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	0.02 ppm	0.02 ppm	IIB	Cattle, swine kidney liver muscle	NADA 55-080 & 55-089 Beecham	
Ampicillin	Tissue extracts quantified by HPLC using fluorometer	0.01 ppm	0.01 ppm	IIB	Cattle, swine kidney liver muscle	Sec. 5.048 FSIS Chemistry Lab Guidebook	
Ampicillin trihydrate	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	0.01 ppm	0.01 ppm	IIB	Cattle, swine all	NADA 55-030 Squibb	
Apramycin	Sample extraction TLC; bioautographed using <i>Bacillus subtilis</i> as a test organism	0.05 ppm	0.1 ppm	IIB	Swine/kidney muscle	Sec. 5.047 FSIS Chemistry Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Arsanilate sodium Arsanilic acid Arsenate, Calcium Arsenate, Copper Arsenate, Lead Arsenate, Magnesium Arsenate, Sodium Arsenic Arsenite, Potassium Arsenite, Sodium	Dry ashed tissue dissolved and reacted to produce arsine gas, which is quantified by AAS Dry ashed tissue dissolved and reacted to produce arsine gas, which reacts to form blue complex for colorimetric quantification	0.05 ppm 0.05 ppm	NE 0.20 ppm	IE IIA	All/kidney liver muscle All/kidney liver muscle	Sec. 5.009 FSIS Chemistry Lab Guidebook AOAC Book of Methods 14th Edit., 25.050	
Atrazine	Fat extracted using C18 columns and quantified by capillary GC with nitrogen/phosphorous detector	5 ppb	NE	II E	All/fat	Copy available upon request	
Bacitracin methylene disalicylate Bacitracin, zinc	Extracts confirmed by GC/MS Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	5 ppb 0.05 ppm	NE NE	IE IID	All/fat All/kidney liver muscle	Sec. 5.032 FSIS Chemistry Lab Guidebook Kramer et al. FDA 1974	
Bambermycins	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	25 ppb	NE	IID	All/kidney liver muscle	NADA 44-759 Hoechst	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Bendiocarb	GPC plus HPLC with post-column fluorescence detection	0.05 ppm	NE	IIE	All/liver	Copy available upon request	
Benomyl	pH extraction with organic solvents; followed by HPLC with UV detection; extracts derivatized and confirmed by GC/EI/MS	0.05 ppm	NE	IIE	Poultry/liver muscle	Copy available upon request	
BHC	Micro alumina assay: column chromatography plus GLC	0.01 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.01 ppm	0.05 ppm	IIA	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	Beta and delta isomers: GPC plus GLC	0.02 ppm	0.05 ppm	IIA-2b	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	Mills method: Florisil column chromatography plus GLC	0.02 ppm	0.10 ppm	IIB	All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook	
	Extracts from GPC or Mills confirmed by GC/MS	0.02 ppm	NE	IE (GPC/MS) IF (Mills/MS)	All/fat pp	Sec. 5.004 FSIS Chemistry Lab Guidebook	
Bromoxynil	GPC plus CLC (Hopper method)	0.05 ppm	NE	IIE	All/fat	Copy available upon request	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Bufencarb	GPC plus HPLC with post-column fluorescence detection Extracts are subjected to reverse phase chromatography, derivatized and confirmed by GC/MS	5 ppb	10 ppb	IIE	All/liver IE	Copy available upon request	
Buquinolate	Zymark Pytechnolgy System: tissue extracts screened by HPLC/UV	NE	NE	IIIE	Cattle/liver muscle	Copy available upon request	
Cacodylic acid	Dry ashed tissue is dissolved and reacted to produce arsine gas, which is quantified by AAS	0.05 ppm	NE	IE	All/kidney liver muscle	Sec. 5.009 FSIS Chemistry Lab Guidebook	
	Dry ashed tissue is dissolved and reacted to produce arsine gas, which reacts to form blue complex for colorimetric quantification	0.05 ppm	0.20 ppm	IIA	All/kidney liver muscle	AOAC Book of Methods, 14th Edit., 25.050	
Cadmium	Dry ashed tissue is dissolved and quantified by AAS	0.10 ppm	0.30 ppm	IB	All/kidney liver muscle	Sec. 5.010 FSIS Chemistry Lab Guidebook	
	Dry ashed tissue is dissolved and quantified by inductively coupled plasma (ICP)	NE	1.67 ppb	IE	All/kidney liver muscle	Copy available upon request	
	Dry ashed tissue is quantified by anodic stripping voltammetry	1.0 ppb	NE	IF	Poultry kidney liver	JAOAC, 60, 4, 826-832(1977)	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Calcium	Tissue is wet ashed and titrated with specific indicator	0.03%	0.03%	IIA	All/muscle	AOAC Book of Methods, 14th Edit., 24.062	
	Wet ashed tissue is quantified by AAS	NE	NE	IE	All	Sec. 6.008 FSIS Chemistry Lab Guidebook	
Cambendazole	Extraction with organic solvents followed by HPLC with UV detection; extracts confirmed by GC/EI/MS	0.05 ppm	NE	IIE	Red meat liver muscle pp	Copy available upon request	
Captan	GPC plus GLC	0.02 ppm	0.05 ppm	IIA-2b	Red meat/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
Carbadox	Tissue extract is hydrolyzed and a derivative is prepared and separated by ion exclusion chromatography, then quantified by GC-ECD	7.5 ppb	30 ppb	IIB	Swine liver muscle	Sec. 5.014 FSIS Chemistry Lab Guidebook	
	Extracts confirmed by GC/EI/MS	7.5 ppb	NE	IE	Swine liver muscle	Copy available upon request	
Carbarsonne	Dry ashed tissue is dissolved and reacted to produce arsine gas, which is quantified by AAS	0.05 ppm	NE	IE	All/kidney liver muscle	Sec. 5.009 FSIS Chemistry Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Carbarsonone, continued	Dry ashed tissue is dissolved and reacted to produce arsine gas, which reacts to form blue complex for colorimetric quantification	0.05 ppm	0.20 ppm	IIA	All/kidney liver muscle	AOAC Book of Methods, 14th Edit., 25.050	
Carbaryl	GPC plus HPLC with post-column fluorescence detection Extracts are subjected to reverse phase chromatography, derivatized and confirmed by GC/MS	5 ppb	10 ppb	IIE IE	All/liver	Copy available upon request	
Carbofuran and metabolite	GPC plus HPLC with post-column fluorescence detection Extracts are subjected to reverse phase chromatography, derivatized and confirmed by GC/MS	5 ppb	10 ppb	IIE IE	All/liver	Copy available upon request	
Carbophenothion	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	0.10 ppm	NE	IIB	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.03 ppm	0.20 ppm	IIA-2b	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	GPC extracts are confirmed by CG/EI/MS	0.01 ppm	NE	IE	Red meat/fat	To be added to Sec. 5.004 FSIS Chemistry Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Chloramphenicol	Tissue extracts are screened by E-Z screen	25 ppb	NE	IIIE	Cattle, swine muscle kidney	Environmental Diagnostics	
	Tissue extract screened for chloramphenicol by CELIA CA	5 ppb	NE	IIE	Cattle, swine muscle	Antimic.Ag. Chemo., 25, 2, 205-211(1984)	
	Extraction of parent and glucuronide using C18 columns with GC capillary quantification as the trimethylsilyl derivative	0.15 ppb	NE	IIE	Cattle, swine muscle	Copy available upon request-- Replaces Sec. 5.022	
	Extracts are confirmed using NICI/MS	0.15 ppb	NE	IE	Cattle, swine muscle pp	Sec. 5.023 FSIS Chemistry Lab Guidebook; amended criteria available upon request	
	C18 cleanup of the hydrolyzed extract with GC capillary quantification as the trimethyl derivative	5 ppb	NE	IIE	Cattle/urine	Copy available upon request	
	Extracts are confirmed using NICI/MS	5 ppb	NE	IE	Cattle/urine	Sec. 5.023 FSIS Chemistry Lab Guidebook; amended criteria available upon request	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Chlordane	Micro alumina assay: column chromatography plus GLC	0.15 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.10 ppm	0.30 ppm	IIA	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	Mills method: Florisil column chromatography plus GLC	0.15 ppm	0.30 ppm	IIB	All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook	
Chlordecone	Extracts from GPC or Mills are confirmed by GC/MS	0.10 ppm	NE	IE (GPC/MS) IF (Mills/MS)	All/fat pp	Sec. 5.004 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.03 ppm	0.20 ppm	IIA-2b	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	GPC extracts are confirmed by GC/EI/MS	0.05 ppm (poultry) 0.20 ppm (cattle)	NE	IE	Poultry, red meat fat	To be added to Sec. 5.004 FSIS Chemistry Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	TEST METHOD				Species/ Tissues	Reference
		LDL/ MIC	MPL	Level/ Status			
2-Chloro-1-(2,4,-di-chlorophenyl) vinyl diethyl phosphate	GPC plus GLC	0.03 ppm	0.10 ppm	IIA-2b	Cattle, sheep/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	GPC extracts are confirmed by GC/EI/MS	0.01 ppm (poultry) 0.10 ppm (red meat)	NE	IE	Poultry, red meat fat	To be added to Sec. 5.004 FSIS Chemistry Lab Guidebook	
2-Chloro-1-(2,4,5-tri-chlorophenyl) vinyl dimethyl phosphate	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	NE	NE	III	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.05 ppm	0.30 ppm	IIA-2b	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	GPC extracts are confirmed by GC/EI/MS	0.05 ppm (poultry) 0.10 ppm (cattle)	NE	IE	Poultry, red meat fat	To be added to Sec. 5.004 FSIS Chemistry Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Chlorpyrifos	Tissue extracts are quantified by GLC with muscle flame photometric or nitrogen-phosphorous flame ionization detector	NE	NE	IIB	All/liver	Sec. 5.006 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.05 ppm	0.20 ppm	IIA-2b	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	GPC extracts are confirmed by GC/EI/MS	0.02 ppm (poultry) 0.10 ppm	NE	IE	Poultry, red meat fat	To be added to Sec. 5.004 FSIS Chemistry Lab Guidebook	
Chlortetracycline	Antibiotic screen test (Swab): ability of tissue fluids containing antimicrobial activity to inhibit microbial growth	0.01 ppm	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831	
	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	0.01 ppm	NE	IID	All/kidney liver muscle	Sec. 6.312 FSIS Microbiology Lab Guidebook	
	Tissue extraction of parent drug is converted to anhydro derivative for identification by TLC	0.1 ppm	NE	IIE	All/kidney liver muscle	Copy available upon request	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Chromium	Dry ashed tissue is extracted with organic reagent and quantified using AAS	NE	NE	IE	All/kidney liver muscle	Sec. 5.010 FSIS Chemistry Lab Guidebook	
Clopidol	Organic solvent extraction with HPLC-UV detection	0.1 ppm	NE	IIE	Poultry/liver	JAOAC, 67, 2, 334-336 (1984)	
	Organic solvent extraction with GC-EC detection	0.1 ppm	NE	IIA	Poultry/liver	AOAC Book of Methods, 14th Edit., 41.013.	
Clorsulon	Tissue extracts are quantified by HPLC-UV detection	0.25 ppm	0.50 ppm	IIB	Red meat kidney muscle liver pp	Sec. 5.045 FSIS Chemistry Lab Guidebook	
	Tissue extracts for HPLC are derivatized and confirmed by GC/MS	0.5 ppm	NE	IB	Red meat kidney muscle liver pp	Sec. 5.045 FSIS Chemistry Lab Guidebook	
Cloxacillin	Antibiotic screen test (Swab): ability of tissue fluids containing antimicrobial activity to inhibit microbial growth	0.16 ppm	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831	
	Microbiological assay combined with HPLC separation and quantified by microbial inhibition	0.02 ppm	NE	IIF	Dairy cows kidney liver muscle	NADA 55-069 Beecham- Masengill	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Cobalt	Dry ashed tissue is dissolved and quantified using AAS	0.20 ppm	NE	IB	All/kidney liver muscle	Sec. 5.010 FSIS Chemistry Lab Guidebook	
				IE			Copy available upon request
Copper	Dry ashed tissue is dissolved and quantified using AAS	0.50 ppm	NE	IB	All/kidney liver muscle	Sec. 5.010 FSIS Chemistry Lab Guidebook	
				IE			Copy available upon request
Coumaphos and oxygen analog	Dry ashed tissue is dissolved and quantified by inductively coupled plasma (ICP)	NE	0.67 ppb	IE	All/kidney liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook	
				IIE			Copy available upon request
				IIE			Copy available upon request
Coumaphos and oxygen analog	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	0.10 ppm	NE	IIE	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook	
				IIE			Copy available upon request
Coumaphos and oxygen analog	GPC plus GLC	0.15 ppm	0.30 ppm	IIE	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
				IIE			Copy available upon request
Coumaphos and oxygen analog	GPC extracts are confirmed by CG/EI/MS	0.20 ppm	0.30 ppm	IE	Red meat/fat	To be added to Sec. 5.004 FSIS Chemistry Lab Guidebook	
				IIE			Copy available upon request
Coumaphos and oxygen analog	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	NE	NE	IIE	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook	
				IIE			Copy available upon request

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Comaphos and oxygen analog, continued	GPC plus GLC	0.15 ppm	0.30 ppm	IIA-2b	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	GPC extracts are confirmed by CG/EI/MS	0.10 ppm	NE	IE	Red meat/fat	To be added to Sec. 5.004 FSIS Chemistry Lab Guidebook	
Cresylic acid	Tissue extracts are derivatized and determined by GC-EC	NE	NE	IIIE	Poultry/fat	Sec. 5.036 FSIS Chemistry Lab Guidebook	
Cruformate	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	0.10 ppm	NE	IIB	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook	
Cyanide salts	Aqueous extraction followed by a colorimetric determination	0.5 ppm	NE	IIIE	All/all	Sec. 5.038 FSIS Chemistry Lab Guidebook	
	For confirmation, cyanogen chloride is produced and determined by GC/EC	0.5 ppm	NE	IE	All/all	Sec. 5.038 FSIS Chemistry Lab Guidebook	
Cyano (3-phenoxy-chlorophenyl) methyl-4-a-(methylene) benzeneacetate [fenvalerate]	Organic solvent extracts are quantified as the sum of both isomers by GC/EC; extracts are confirmed by GC/EI/MS	0.03 ppm	NE	IIE IE	All/fat	Copy available upon request	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Cypermethrin	Organic solvent extracts are quantified as the sum of three isomers by GC/EC; extracts are confirmed by GC/EI/MS	0.03 ppm	NE	IIE IE	All/fat	Copy available upon request	
Cyromazine and melamine metabolite	Tissue extracts are quantified by HPLC-UV detection	0.05 ppm	0.25 ppm	IIB IIB ¹	Poultry muscle pp Red meat muscle pp	Sec. 5.0371 FSIS Chemistry Lab Guidebook	
2,4-D	Extracts are used to confirm cyromazine and melamine residues by GC/EI/MS using polymethylsilyl derivative	0.05 ppm	NE	IE	All/muscle	Copy available upon request	
DDE (metabolites of DDT collectively reported as DDT)	GPC plus CLC (Hopper method)	0.2 ppm	NE	IIE	All/fat	Copy available upon request	
	Micro alumina assay: column chromatography plus GLC	0.02 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.02 ppm	0.05 ppm	IIA	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	Mills method: Florisil column chromatography plus GLC	0.02 ppm	0.10 ppm	IIB	All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook	

¹ Method validated at 0.4 ppm for cyromazine and 0.1 ppm for melamine, reevaluated at 0.05 ppm in poultry and red meats to meet new tolerance.

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
DDE, continued	Extracts from GPC or Mills are confirmed by GC/MS	0.02 ppm	NE	IE (GPC/MS) IF (Mills/MS) IIE	All/fat pp	Sec. 5.004 FSIS Chemistry Lab Guidebook	
DDT (isomers of DDT collectively reported as DDT)	Micro alumina assay: column chromatography plus GLC GPC plus GLC	0.04 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
		0.04 ppm	0.15 ppm	IIA	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
		0.04 ppm	0.15 ppm	IIB	All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook	
Decoquinat	Mills method: Florisil column chromatography plus GLC Zymark Pytechnology System; organic solvent extraction followed by HPLC with fluorescence detection	0.20 ppm	0.5 ppm	IIB-2	Cattle, poultry liver muscle	Copy available upon request	
Deltamethrin	Organic solvent extracts are quantified by GC/EC; extracts are confirmed by GC/EI/MS	0.025 ppm	NE	IIE IE	All/fat	Copy available upon request	
Diazinon	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	0.1 ppm	NE	IIB	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Dibutyltin dilaurate	Tissue extraction acidhydrolysis--morin derivatization--HPLC-UV	0.25 ppm	NE	IE (with AA for tin)	Turkey/liver	Copy available upon request	
Dicamba	GPC plus CLC (Hopper method)	0.1 ppm	NE	IIE	All/fat	Copy available upon request	
Dichlorvos	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	NE	NE	IIA	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook	
Dieldrin	Micro alumina assay: column chromatography plus GLC	0.01 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.01 ppm	0.05 ppm	IIA	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	Mills method: Florisil column chromatography	0.01 ppm	0.10 ppm	IIB	All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook	
	Extracts from GPC or Mills are confirmed by GC/MS	0.02 ppm	NE	IE (GPC/MS) IF (Mills/MS)	All/fat pp	Sec. 5.004 FSIS Chemistry Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD		Species/ Tissues	Reference
			MPL	Level/ Status		
O, O-Diethyl S-[2-(ethyl- thio)ethyl] phosphoro- dithioate	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	NE	NE	IIF	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook
Diethylstilbestrol (DES)	Solid phase extraction technique using an internal standard followed by methylation for GC/MS quantification and confirmation	0.1 ppb	0.2 ppb	IB IE	Cattle, sheep liver, muscle Cattle/kidney muscle	Sec. 5.051 FSIS Chemistry Lab Guidebook
Dihydrostreptomycin	Antibiotic screen test (Swab): ability of tissue fluids containing anti-microbial activity to inhibit microbial growth	0.25 ppm	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831
3, 5-Dimethyl-4- (methylthio)phenyl methylcarbamate and metabolite	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	0.25 ppm	NE	IID	All/kidney liver muscle	Sec. 6.315 FSIS Microbiology Lab Guidebook
	GPC plus HPLC with post- column fluorescence detection Extracts are subjected to reverse phase chromatography, derivatized and confirmed by GC/MS	5 ppb	10 ppb	IIE IE	All/liver	Copy available upon request

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status	MPL		
Dimetridazole and hydroxy metabolite	Extracts are quantified by HPLC/UV	1.0 ppb	NE	IIE		Turkey, swine muscle	Copy available upon request
	Tissue extracts from HPLC are confirmed by GC/NICI/MS	1.0 ppb	NE	IE		Turkey, swine muscle	Copy available upon request
Dioxacarb	GPC plus HPLC with post-column fluorescence detection	0.05 ppm	NE	IIE		All/liver	Copy available upon request
Dioxathion	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	0.10 ppm	NE	IIB		All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook
Dodecachloro-octahydro-1, 3, 4-metheno-2H-cyclobuta(cd)-pentalene	Micro alumina assay: column chromatography plus GLC GPC plus GLC	0.04 ppm 0.04 ppm	NE 0.10 ppm	IIE IIA		All/fat pp All/fat	Sec. 5.002 FSIS Chemistry Lab Guidebook AOAC Book of Methods, 14th Edit., 29.037
	Mills method: Florisil column chromatography plus GLC	0.04 ppm	0.10 ppm	IIB		All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook
Endosulfan I	GPC plus GLC	0.01 ppm	0.10 ppm	IIA-2b		All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Endosulfan I, continued	GPC extracts are confirmed by GC/EI/MS	0.02 ppm	NE	IE	Red meat/fat	To be added to Sec. 5.004 FSIS Chemistry Lab Guidebook	
Endosulfan II	GPC plus GLC	0.02 ppm	0.20 ppm	IIA-2b	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
Endrin	Micro alumina assay: column chromatography plus GLC	0.03 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.03 ppm	0.05 ppm	IIA	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	Mills method: Florisil column chromatography plus GLC	0.03 ppm	0.10 ppm	IIB	All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook	
	Extracts from GPC or Mills are confirmed by GC/MS	0.05 ppm	NE	IE (GPC/MS) IF (Mills/MS)	All/fat pp	Sec. 5.004 FSIS Chemistry Lab Guidebook	
Erythromycin	Antibiotic screen test (Swab): ability of tissue fluids containing antimicrobial activity to inhibit microbial growth	25 ppb	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD		Species/ Tissues	Reference
			MPL	Level/ Status		
Erythromycin, continued	Microbiological assay procedure: ability of tissue fluids containing antimicrobial activity to inhibit microbial growth	25 ppb	NE	IID	All/kidney liver muscle	Sec. 6.316 FSIS Microbiology Lab Guidebook
Ethion and oxygen analog	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	0.10 ppm	NE	IIB	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook
	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	NE	NE	IIE	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook
Ethylene dibromide	Residue is co-distilled from aqueous suspension and quantified by GLC	0.5 ppb	1.0 ppb	IIB	All/fat	Sec. 5.005 FSIS Chemistry Lab Guidebook
	MS by NICI to determine bromine	1 ppb	NE	IE	All/fat	Sec. 5.005 FSIS Chemistry Lab Guidebook
Fenbendazole	Extraction with organic solvents followed by HPLC with UV detection; extracts derivatized and confirmed by GC/EI/MS	0.10 ppm	NE	IIE IE	Red meat liver muscle	Copy available upon request

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD		Species/ Tissues	Reference
			MPL	Level/ Status		
Fenbendazole, continued	Tissue extracts are quantified by HPLC	200 ppb	400 ppb	IIB	Cattle, calf liver	NADA 128-620 American Hoechst
Fenitrothion	Quantification extract purified by TLC, derivatized and identified by HPLC fluorescence Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	200 ppb 0.10 ppm	NE	IIB	Cattle, calf liver All/liver muscle	NADA 128-620 American Hoechst Sec. 5.006 FSIS Chemistry Lab Guidebook
Fenthion	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	NE	NE	IIE	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook
Flucythrinate	Tissue extracts are quantified by GLC with KCl thermionic detector	0.10 ppm	NE	IIE	All/liver muscle	Sec. 5.016 FSIS Chemistry Lab Guidebook
Gasoline	Organic solvent extracts are quantified as the sum of both isomers by GC/EC; extracts are confirmed by GC/EI/MS Fat from product is heated in a sealed vial and gasoline components are identified by pattern recognition using GC/flame ionization detection	1 ppm 0.1 ppm	NE	IIE	Red meat/fat All/muscle	Copy available upon request Sec. 5.027 FSIS Chemistry Lab Guidebook

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Gentamicin sulfate	Tissue extracts are screened by E-Z Screen	50 ppb	NE	IIIE	All/muscle liver kidney	Environmental Diagnostics	
	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	NE	NE	IIB	Swine/kidney	NADA 103-037& 91-191 Schering	
Gentian violet	Extraction followed by detection by HPLC with fluorescence detector	0.2 ppm	0.4 ppm	IB	Swine/kidney	Sec. 5.043 FSIS Chemistry Lab Guidebook	
	Method attributes are being determined						
Halofuginone	Tissue extracts are quantified by HPLC/UV	0.05 ppm	0.05 ppm	IIB	Chicken/liver muscle	Sec. 5.041 FSIS Chemistry Lab Guidebook	
	Tissue extracts are confirmed by GC/MS/MS	0.05 ppm	NE	IB	Chicken/liver muscle	NADA 130-951 American Hoechst	
HCB	Micro alumina assay: column chromatography plus GLC	0.01 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.01 ppm	0.05 ppm	IIA	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	TEST METHOD				Species/ Tissues	Reference
		LDL/ MIC	MPL	Level/ Status			
HCB, continued	Mills method: Florisil column chromatography plus GLC	0.01 ppm	0.10 ppm	IIB	All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook	
	Extracts from GPC or Mills are confirmed by GC/MS	0.01 ppm	NE	IE (GPC/MS) IF (Mills/MS)	All/fat pp	Sec. 5.004 FSIS Chemistry Lab Guidebook	
Heptachlor and heptachlor epoxide	Micro alumina assay: column chromatography plus GLC	0.01 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.01 ppm	0.05 ppm	IIA	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	Mills method: Florisil column chromatography plus GLC	0.01 ppm	0.10 ppm	IIB	All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook	
Hetacillin, Potassium	Extracts from GPC or Mills are confirmed by GC/MS	0.02 ppm	NE	IE (GPC/MS) IF (Mills/MS)	All/fat pp	Sec. 5.004 FSIS Chemistry Lab Guidebook	
	Antibiotic screen test (Swab): ability of tissue fluids containing anti-microbial activity to inhibit microbial growth	NE	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
5-Hydroxy-thiabendazole	Extraction with organic solvents followed by HPLC with UV detection; extracts confirmed by derivatized GC/EI/MS	0.05 ppm	NE	IIE IE	Red meat liver muscle	Copy available upon request	
Hygromycin B	Antibiotic screen test (Swab): ability of tissue fluids containing antimicrobial activity to inhibit microbial growth	5.00 ppm	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831	
Ipronidazole and hydroxy metabolite	Tissue extracts are quantified by HPLC/UV	1.0 ppb	NE	IIE	Turkey, swine muscle	Copy available upon request	
	Tissue extracts from HPLC are confirmed by GC/NICI/MS	1.0 ppb	NE	IE	Turkey, swine muscle	Sec. 5.013 FSIS Chemistry Lab Guidebook	
Iron	Dry ashed tissue is dissolved and quantified by AAS	0.50 ppm	NE	IB	All/kidney liver muscle	Sec. 5.010 FSIS Chemistry Lab Guidebook	
	Dry ashed tissue is dissolved and quantified by inductively coupled plasma (ICP)	NE	16.0 ppb	IE	All/kidney liver muscle	Copy available upon request	
	Dry ashed tissue is dissolved and reacted to produce a red complex, which is quantified by colorimetry	NE	NE	IIE	All/all	Sec. 6.009 FSIS Chemistry Lab Guidebook	
	Wet ashed tissue is quantified by AAS	NE	NE	IIIE	All/kidney liver muscle	Sec. 6.008 FSIS Chemistry Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Ivermectin	Tissue extracts are quantified by HPLC fluorescence	2 ppb	5 ppb	IIB	Red meat liver muscle	Sec. 5.035 FSIS Chemistry Lab Guidebook	
	Derivatization to form 3 components with detection by HPLC fluorescence	2 ppb	NE	IB	Red meat liver muscle	Sec. 5.035 FSIS Chemistry Lab Guidebook	
Lasalocid	Tissue extracts are quantified by HPLC fluorescence detector	0.025 ppm 0.025 ppm	0.35 ppm NE	IIB IIE	Cattle/liver Poultry/fat skin	Sec. 5.029 FSIS Chemistry Lab Guidebook	
	Tissue extraction followed by bioautography	0.005 ppm	0.01 ppm	IIB	Poultry/fat skin	NADA 96-298V Hoffman-LaRoche	
	GC pyrolysis of the HPLC extract with MS identification of the fragments	0.2 ppm	NE	IB	Cattle/liver	NADA 96-298V Hoffman-LaRoche	
	Dry ashed tissue is dissolved and quantified by AAS	0.03 ppm	0.05 ppm	IE	Poultry/fat, skin	Sec. 5.010 FSIS Chemistry Lab Guidebook	
Lead	Dry ashed tissue is dissolved and quantified by inductively coupled plasma (ICP)	NE	1.67 ppb	IE	All/kidney liver muscle	Copy available upon request	
	Dry ashed tissue is quantified by anodic stripping voltammetry	1.0 ppb	NE	IE	Poultry kidney liver	JAOAC, 60, 4, 826-832(1977)	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status	MPL		
Levamisole	Tissue extracts are quantified by GLC flame photometric detection	0.05 ppm	NE	IIE	Red meat liver muscle	Sec. 5.033 FSIS Chemistry Lab Guidebook	
Lincomycin hydrochloride	Tissue extracts are subjected to GC/MS	0.05 ppm	NE	I ¹ E	Red meat liver muscle	Copy available upon request	
	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	0.10 ppm	0.10 ppm	IIC	Poultry, swine/all	NADA 97-505 Upjohn	
Lindane	Micro alumina assay: column chromatography plus GLC	0.01 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.01 ppm	0.05 ppm	IIA	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	Mills method: Florisil column chromatography plus GLC	0.01 ppm	0.10 ppm	IIB	All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook	
	Extracts from GPC or Mills are confirmed by GC/MS	0.01 ppm	NE	IE (GPC/MS) IF (Mills/MS)	All/fat pp	Sec. 5.004 FSIS Chemistry Lab Guidebook	

¹ Applies only when used in combination with FSIS Chemistry Lab Guidebook Section 5.033 method.

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Linuron	GPC plus GLC	0.25 ppm	0.50 ppm	IIA-2b	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	Extracts are confirmed by GC/EI/MS	0.05 ppm	NE	IE	Red meat fat	To be added to Sec. 5.004 FSIS Chemistry Lab Guidebook	
Lysergic acid diethylamide	Tissue extracts are spotted for TLC and detected with specific chromagenic reagent	NE	NE	I ¹ E	All/kidney liver muscle pp	Sec. 5.028 FSIS Chemistry Lab Guidebook	
Malathion	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	0.10 ppm	NE	IIB	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook	
Manganese	Dry ashed tissue is dissolved and quantified by AAS	0.05 ppm	NE	IE	All/kidney liver muscle	Sec. 5.010 FSIS Chemistry Lab Guidebook	
	Dry ashed tissue is dissolved and quantified by inductively coupled plasma (ICP)	NE	0.67 ppb	IE	All/kidney liver muscle	Copy available upon request	
Mebendazole	Extraction with organic solvents followed by HPLC with UV detection; extracts are confirmed by GC/EI/MS	0.05 ppm	NE	IIE IE	Red meat liver muscle	Copy available upon request	

1 Applies only to compound identification.

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD		Species/ Tissues	Reference
			MPL	Level/ Status		
Melengestrol acetate (MGA)	Tissue extract is column chromatographed on Florisil and quantified by GLC	5.0 ppb	10.0 ppb	IIB&C	Cattle/muscle kidney liver fat	Sec. 5.040 FSIS Chemistry Lab Guidebook
	Extracts are derivatized with HFB and confirmed by GC/EI/MS	5.0 ppb	10.0 ppb	IE	Cattle/fat	Copy available upon request
Mercury	Tissue is digested in acid. Mercury is reduced to its vapor and quantified by flameless AAS	0.01 ppm	0.02 ppm	IB	All/kidney liver muscle	Sec. 5.007 FSIS Chemistry Lab Guidebook
Methanearsonic acid	Dry ashed tissue is dissolved and reacted to produce arsine gas, which is quantified by AAS	ppm	0.05	NE	IE liver muscle	All/kidneySec. 5.009 FSIS Chemistry Lab Guidebook
	Dry ashed tissue is dissolved and reacted to produce arsine gas, which reacts to form blue complex for colorimetric quantification	ppm	0.05 ppm	0.20	IIA liver muscle	All/kidneyAOAC Book of Methods, 14th Edit., 25.050
Methomyl	GPC plus HPLC with post-column fluorescence detection	5 ppb	10 ppb	IIE	All/liver	Copy available upon request
	Extracts are subjected to reverse phase chromatography, derivatized and confirmed by GC/MS			IE		

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Methoxychlor	Micro alumina assay: column chromatography plus GLC	0.15 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
			0.50 ppm	IIA	All/fat		
			0.50 ppm	IIB	All/fat pp		
Methyl parathion	Extracts from GPC or Mills are confirmed by GC/MS	0.15 ppm	NE	IE (GPC/MS) IF (Mills/MS)	All/fat pp	Sec. 5.004 FSIS Chemistry Lab Guidebook	
			0.10	IIB	All/liver muscle		
			0.10	IIB	Cattle, poultry liver fat		
Monensin	Tissue extract is hydro- lyzed and a derivative is quantified by GLC	0.25 ppm	0.10 ppm	IIB	Cattle, poultry liver fat	NADA 38-878V Eli Lilly	
			0.50 ppm	IIB	Cattle/liver		
			0.50 ppm	IIE	Cattle/muscle		

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Morantel tartrate, continued	Identification of a structurally significant hydrolyzed fragment by GC/MS	0.25 ppm	NE	IB	Cattle/liver muscle	NADA 92-444 NADA 93-903 Pfizer	
Narasin	Tissue extracts are spotted on TLC and quantified with a bio- autographic overlay	5 ppb	NE	IIB	Cattle, poultry liver kidney fat Lab Guidebook	Sec. 5.042 FSIS Chemistry	
Neomycin sulfate	Tissue is deproteinized, acidified, and extracted; quantified by HPLC/UV	1.5 ppm	NE	IIB	All/kidney	FDA Center for Veterinary Medicine- sponsored validatio; copy available	
	Antibiotic screen test (Swab): ability of tissue fluids containing anti-microbial activity to inhibit microbial growth	0.25 ppm	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831	
	Tissue extracts are screened by E-Z Screen	50 ppb	NE	IIIE	All/muscle liver kidney	Environmental Diagnostics	
	Microbiological assay pro- cedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	0.25 ppm	NE	IID	All/kidney liver muscle	Sec. 6.317 FSIS Microbiology Lab Guidebook	
Nequinatate	Zymark Pytechnlogy System: Tissue extracts are screened by HPLC/UV	NE	NE	IIIE	Cattle/liver muscle	Copy available upon request	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Nicarbazin	Tissues are extracted with ethyl acetate; the dinitrocarbanilide moiety is quantified by HPLC with a UV detector Extracts verified by photodiode array detection	0.1 ppm	2.0 ppm	IIB	Chicken all tissues	NADA AM AA-CARIIO-AB755 Eli Lilly	
				IE			Information available upon request
Nickel	Dry ashed tissue is dissolved and quantified by AAS	0.20 ppm	NE	IB	All/kidney liver muscle	Sec. 5.010 FSIS Chemistry Lab Guidebook	
			0.34 ppb	IE			Copy available upon request
Nonachlor	Micro alumina assay: column chromatography plus GLC	0.05 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
			0.15 ppm	IIA			All/fat
	Mills method: Florisil column chromatography plus GLC	0.05 ppm	0.15 ppm	IIB	All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook	
			NE	IE			All/fat pp

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Novobiocin	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	0.125 ppm	NE	IID	All/kidney liver muscle	Kramer, et al. FDA 1974	
	Zymark Pytechnology System: organic solvent extraction followed by HPLC/UV detection	0.50 ppm	NE	IIE	All/kidney liver muscle	Copy available upon request	
	Manual system organic solvent extraction followed by HPLC/UV detection	0.50 ppm	NE	IIE	All/kidney liver muscle	Copy available upon request	
Oleandomycin	Antibiotic screen test (Swab): ability of tissue fluids containing antimicrobial activity to inhibit microbial growth	0.25 ppm	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831	
Oxfendazole	Extraction with organic solvents followed by HPLC with UV detection; extracts are derivatized and confirmed by GC/EI/MS	0.05 ppm	NE	IIE	Red meat, pp liver muscle IE	Copy available upon request	
Oxytetracycline hydrochloride	Antibiotic screen test (Swab): ability of tissue fluids containing antimicrobial activity to inhibit microbial growth	0.08 ppm	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Oxytetracycline hydrochloride, continued	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	0.08 ppm	0.08 ppm	IID	All/kidney liver muscle	Sec. 6.312 FSIS Microbiology Lab Guidebook	
	Tissue extraction of parent drug is converted to anhydro derivative for identification by TLC	0.1 ppm	NE	IIE	All/kidney liver muscle	Copy available upon request	
Parathion	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	NE	NE	IIB	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook	
PBB's	Micro alumina assay: column chromatography plus GLC detection by electron capture. UV degradation of PBB's is used as confirmation	0.05 ppm	NE	IIE	All/fat	Ralston-Purina Method MP-PBB.36 9/12/79	
PCB's (reported as Aroclor 1242, 1248, 1254, 1260, etc.)	Micro alumina assay: column chromatography plus GLC GPC plus GLC	0.30 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
		0.30 ppm	0.50 ppm	IIA-2b	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD		Species/ Tissues	Reference
			MPL	Level/ Status		
Penicillin, procaine and procaine G	Antibiotic screen test (Swab): ability of tissue fluids containing anti- microbial activity to inhibit microbial growth	12.5 ppb	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831
Penicillin G (benzathine, free acid, sodium salt, and procaine salts)	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	12.5 ppb	NE	IID	All/kidney liver muscle	Sec. 6.311 FSIS Microbiology Lab Guidebook
Pentachloroarisole	GPC plus GC	NE	NE	IIA-2b	Poultry/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook
Pentachlorophenol	Extracts confirmed by GC/EI/MS Tissue digestate is extracted with cyclo- hexane and quantified by GLC Tissue extracts for GLC are confirmed by GC/MS	NE 0.03 ppm	NE 0.05 ppm	IIE IIB IE	Poultry/fat All/liver muscle All/liver muscle	Information available upon request Sec. 5.024 FSIS Chemistry Lab Guidebook Sec. 5.025 FSIS Chemistry Lab Guidebook
	GPC plus GC	NE	NE	IIA-2b	Poultry/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Pentachlorophenol, continued	Extracts confirmed by GC/EI/MS	NE	NE	IIE	Poultry/fat	Information available upon request	
Permethrin (cis & trans)	Solvent extraction followed by a competitive ELISA determination	1.0 ppm	NE	IIIE	All/fat	Copy available upon request	
Phencyclidine	Organic solvent extracts are quantified as the sum of both isomers; extracts are confirmed by GC/EI/MS	1.0 ppm	NE	IIE	All/fat	Copy available upon request	
			NE	IE			
Phosalone	Tissue extracts are spotted for TLC with specific chromogenic reagent	NE	NE	IIIE	All/liver muscle	Sec. 5.028 FSIS Chemistry Lab Guidebook	
			0.05 ppm	IIA-2b	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
Propazine	GPC extracts are confirmed by GC/EI/MS	0.02 ppm	NE	IE	Red meat fat	To be added to Sec. 5.004 FSIS Chemistry Lab Guidebook	
			5	NE	IIE	All/fat Copy available upon request	
	Fat extracted using C18 columns and quantified by capillary GC with nitrogen-phosphorous detector	5 ppb	NE	IE	All/fat	Sec. 5.032 FSIS Chemistry Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD		Species/ Tissues	Reference
			MPL	Level/ Status		
Pyrantel tartrate	Tissue extract is hydrolyzed and a derivative is quantified by GLC	0.25 ppm	0.50 ppm	IIB	Swine/liver muscle	Sec. 5.046 FSIS Chemistry Lab Guidebook
	Identification of a structurally significant hydrolyzed fragment by GC/MS	0.25 ppm	NE	IE	Swine/liver muscle	JAOAC, 65, 3 640-646(1982)
Ronnel	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	NE	NE	IIB	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook
	GPC plus GLC	0.02 ppm	0.05 ppm	IIA-2b	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook
	Extracts are confirmed by GC/EI/MS	0.01 ppm (poultry) 0.10 ppm (red meat)	NE	IE	Poultry, red meat fat	To be added to Sec. 5.004 FSIS Chemistry Lab Guidebook
Roxarsone	Dry ashed tissue is dissolved and reacted to produce arsine gas, which is quantified by AAS	0.05 ppm	NE	IE	All/kidney liver muscle	Sec. 5.009 FSIS Chemistry Lab Guidebook

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Roxarsone, continued	Dry ashed tissue is dissolved and reacted to produce arsine gas, which reacts to form blue complex for colorimetric quantification	0.05 ppm	0.20 ppm	IIA	All/kidney liver muscle	AOAC Book of Methods, 14th Edit., 25.050	
Selenium	Tissue is digested in acid and quantified by graphite furnace AAS	0.02 ppm	NE	IE	All/kidney liver muscle	Copy available upon request	
Simazine	Fat extracted using C18 columns and quantified by capillary GC with nitrogen-phosphorous detector	ppb	5	NE	IIE	All/fat Copy available upon request	
Spectinomycin hydrochloride	Extracts confirmed by GC/MS	5 ppb	NE	IE	All/fat	Sec. 5.032 FSIS Chemistry Lab Guidebook	
Streptomycin	Microbiological assay: tissue extracts are quantified using a turbidimetric assay	2.8 ppm	NE	IIIE	All/kidney liver muscle	NADA 47-244 Upjohn	
	Antibiotic screen test (Swab): ability of tissue fluids containing antimicrobial activity to inhibit microbial growth	0.25 ppm	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831	
	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	0.25 ppm	NE	IID	All/kidney liver muscle	Sec. 6.315 FSIS Microbiology Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status	MPL		
Styrene	Tissues are subjected to GC/MS head space analysis	1 ppb	NE	¹ F	All/kidney liver muscle fat pp	Sec. 5.026 FSIS Chemistry Lab Guidebook	
Sulfabromomethazine	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.02 ppm	0.05 ppm	IIA-2b	Red meat liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook	
Sulfachlorpyridazine	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.02 ppm	0.05 ppm	IIA-2b	Red meat liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook	
Sulfadiazine	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.02 ppm	NE	IIA-2b	Red meat liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook	
Sulfadimethoxine	Extraction followed by GC/CI and EI/MS	0.05 ppm	NE	IB-2	Red meat liver muscle	Sec. 5.019 FSIS Chemistry Lab Guidebook	
Sulfadimethoxine	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.02 ppm	0.05 ppm	IIA	All/liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook	

1 Method is semi-quantitative.

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Sulfadimethoxine, continued	Extraction followed by GC/EI/MS	0.05	NE ppm	IB	All/liver muscle	Sec. 5.019 FSIS Chemistry Lab Guidebook Environmental Diagnostics	
	Tissue extracts are screened by E-Z Screen	50 ppb	NE	IIIE	All/liver		
Sulfadoxine	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.05 ppm	NE	IIA-2b	Red meat liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook	
	Tissue extracts are confirmed by GC/EI/MS	NE	NE	IB-2	Red meat liver muscle	Extracts from Sec. 5.018 FSIS Chemistry Lab Guidebook confirmed by GC/EI/MS	
Sulfaethoxypyridazine	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.02 ppm	0.05 ppm	IIA-2b	Red meat liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook	
	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.02 ppm	0.05 ppm	IIA-2a	Red meat/feed concentrate pp		
Sulfamethazine	Tissue extracts are confirmed by GC/EI/MS	0.05 ppm	NE	IB IE	All/liver muscle All/pp	Sec. 5.019 FSIS Chemistry Lab Guidebook	
	Tissue extracts are detected by TLC fluorescence (SOS-urine)	NE	NE	IIIG	Swine/urine	Copy available upon request	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Sulfamethazine, continued	Tissue extracts are screened by E-Z Screen	50 ppb	NE	IIIE	All/liver	Environmental Diagnostics	
Sulfamethoxy- pyridazine	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.02 ppm	0.05 ppm	IIA-2b	Red meat liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook	
Sulfaphenazole	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.05 ppm	NE	IIA-2b	Red meat liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook	
Sulfapyridine	Tissue extracts are confirmed by GC/EI/MS	NE	NE	IB-2	Red meat liver muscle	Extracts from Sec. 5.018 FSIS Chemistry Lab Guidebook confirmed by GC/EI/MS	
Sulfaquinoxaline	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.02 ppm	0.05 ppm	IIA-2b	All/liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook	
	Tissue extracts are confirmed by GC/EI/MS	0.05	NE	IB-1&2	All/liver muscle pp	TLC extracts from Sec. 5.018	
	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	12.5 ppb	25 ppb	IIA1	Poultry/liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook	

1 Method modified and reevaluated at 25 ppb.

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD		Species/ Tissues	Reference
			MPL	Level/ Status		
Sulfaquinoxaline, continued	Tissue extracts are confirmed by GC/EI/MS	25 ppb	NE	IB ¹	Poultry/liver muscle	Sec. 5.019 FSIS Chemistry Lab Guidebook
Sulfathiazole	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.02 ppm	0.05 ppm	IIA-1	Red meat liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook
	Tissue extracts are confirmed by GC/EI/MS	0.05 ppm	NE	IB	Red meat liver muscle pp	Sec. 5.019 FSIS Chemistry Lab Guidebook
Sulfatroxazole	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.05 ppm	NE	IIA-2b	Red meat liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook
	Tissue extracts are confirmed by GC/EI/MS	NE	NE	IB-2	Red meat liver muscle	Extracts from Sec. Sec. 5.018 FSIS Chemistry Lab Guidebook confirmed by GC/EI/MS
Sulfisoxazole	TLC fluorescence: tissue extracts are partitioned by TLC and quantified by densitometry	0.05 ppm	NE	IIA-2b	Red meat liver muscle	Sec. 5.018 FSIS Chemistry Lab Guidebook

¹ Restudied in one laboratory at 25 ppb.

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status	MPL		
Sulfisoxazole, continued	Tissue extracts are confirmed by GC/EI MS	NE	NE	IB-2	Red meat liver muscle	Extracts from Sec. 5.018 FSIS Chemistry Lab Guidebook confirmed by GC/EI/MS	
TDE (metabolite of DDT reported as DDT)	Micro alumina assay: column chromatography plus GLC	0.04 ppm	NE	IIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.03 ppm	0.15 ppm	IIA	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	Mills method: Florisil column chromatography plus GLC	0.04 ppm	0.15 ppm	IIB	All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook	
	Extracts from GPC or Mills are confirmed by GC/MS	0.02 ppm	NE	IE (GPC/MS) IF (Mills/MS)	All/fat pp	Sec. 5.004 FSIS Chemistry Lab Guidebook	
Terbutylazine	Fat extracted using C18 columns and quantified by capillary GC with nitrogen-phosphorous detector	5 ppb	5	NE	IIE	All/fat Copy available upon request	
	Extracts confirmed by GC/MS	5 ppb	NE	IE	All/fat	Sec. 5.032 FSIS Chemistry Lab Guidebook	

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD		Species/ Tissues	Reference
			MPL	Level/ Status		
Terpene polychlorinates	Micro alumina assay: column chromatography plus GLC	0.50 ppm	NE	IIE	All/fat	Sec. 5.002 FSIS Chemistry Lab Guidebook
	Mills method: Florisil column chromatography plus GLC	0.50 ppm	NE	IIE	All/fat	Sec. 5.001 FSIS Chemistry Lab Guidebook
Tetracycline hydrochloride	Antibiotic screen test (Swab): ability of tissue chloride fluids containing anti-microbial activity to inhibit microbial growth	0.08 ppm	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831
	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	0.08 ppm	NE	IID	All/kidney liver muscle	Sec. 6.312 FSIS Microbiology Lab Guidebook
	Tissue extraction of parent drug is converted to anhydro derivative for identification by TLC	0.1 ppm	NE	IIE	All/kidney liver muscle	Copy available upon request
Thiabendazole	pH extraction with organic solvents followed by HPLC with UV detection; extracts derivatized and confirmed by GC/EI/MS	0.05 ppm	NE	IIE IE	Red meat, pp liver muscle	Copy available upon request
Tiamulin	Organic solvent extraction followed by GC of the 8-hydroxymitiin metabolite	0.2 ppm	0.4 ppm	IIB	Swine/liver	INAD 1776 Diamond-Shamrock Corp.

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Tiamulin, continued	Extracts confirmed by GC/MS	NE	0.4 ppm	IB	Swine/liver	INAD 1776 Diamond- Shamrock Corp.	
Tin	Tissue is dry ashed and dissolved and quantified by AAS (used to screen for organotin compounds)	0.02 ppm	NE	IE	All/kidney liver muscle	Sec. 5.009 FSIS Chemistry Lab Guidebook	
Toxaphene	Micro alumina assay: column chromatography plus GLC	0.50 ppm	NE	IIIE	All/fat pp	Sec. 5.002 FSIS Chemistry Lab Guidebook	
	GPC plus GLC	0.50 ppm	NE	IIIE	All/fat	Sec. 5.003 FSIS Chemistry Lab Guidebook	
	Mills method: Florisil column chromatography plus GLC	0.50 ppm	1.00 ppm	IIIB	All/fat pp	Sec. 5.001 FSIS Chemistry Lab Guidebook	
Trichlorfon	Tissue extracts are quantified by GLC with flame photometric or nitrogen-phosphorous flame ionization detector	NE	NE	IIIE	All/liver muscle	Sec. 5.006 FSIS Chemistry Lab Guidebook	
Tylosin	Antibiotic screen test (Swab): ability of tissue fluids containing anti- microbial activity to inhibit microbial growth	0.20 ppm	NE	IIIE	All/kidney	J. Food Prot., 1981, 44, 828-831	

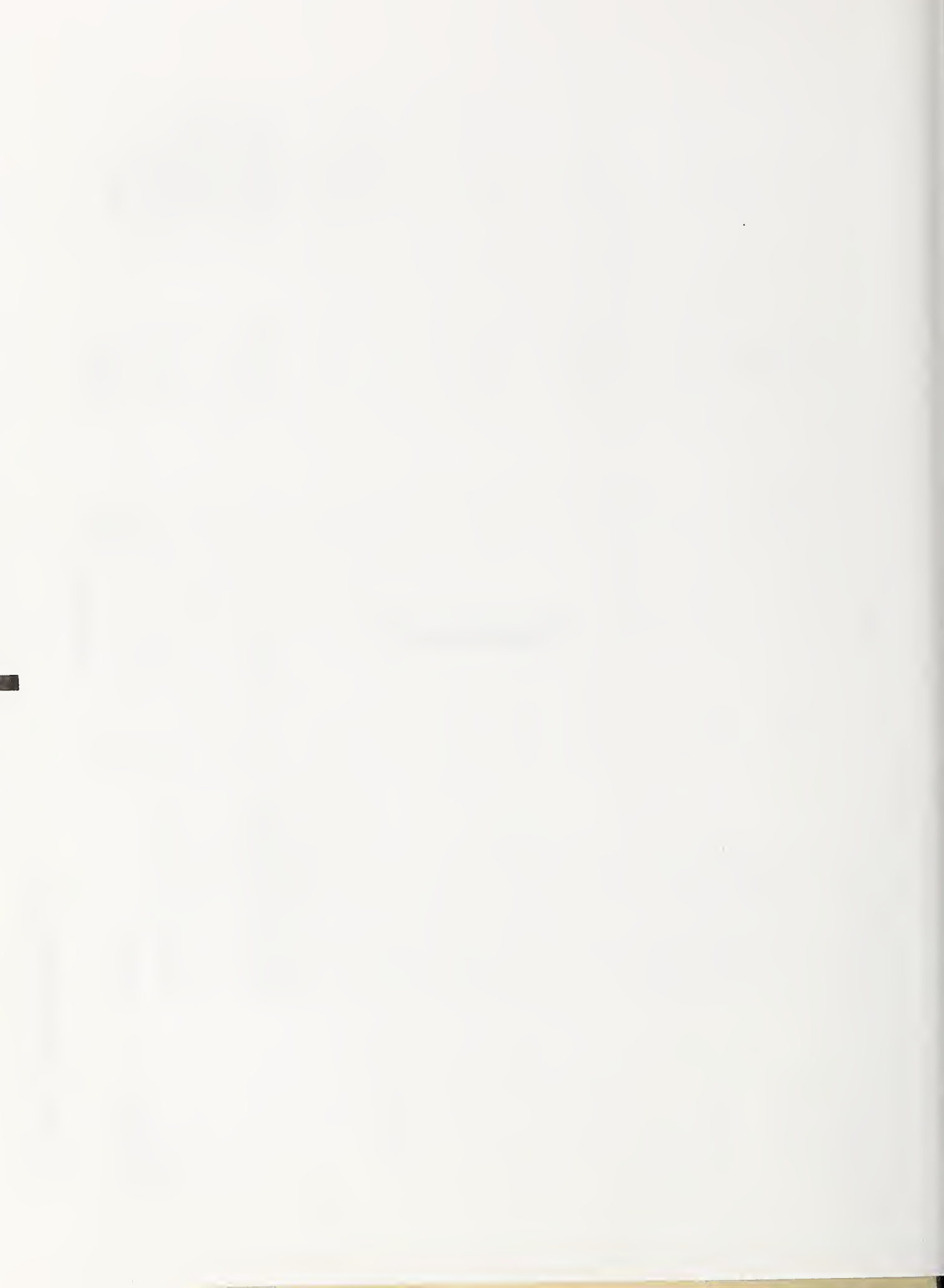
FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	TEST METHOD			Species/ Tissues	Reference
		LDL/ MIC	MPL	Level/ Status		
Tylosin, continued	Tissue extracts are screened by E-Z screen	50 ppb	NE	IIIE	All/muscle liver kidney	Environmental Diagnostics
	Liquid-liquid extraction followed by HPLC-UV detection	0.1 ppm	NE	IIE	Cattle/muscle	Copy available upon request
Virginiamycin	Microbiological assay procedure: ability of tissue extracts containing antimicrobial activity to inhibit microbial growth	0.64 ppm	NE	IIE	Swine kidney liver muscle	NADA 91-467 & 91-513 Smith Kline & French
	Organic solvent extraction followed by HPLC/UV quantification	0.1 ppm	NE	IIE	All/kidney liver muscle	Copy available upon request
Zeranol and metabolite taleranol	Extraction followed by radioimmunoassay	1.0 ppb	NE	IIIE	Cattle/liver muscle	Sec. 5.049 FSIS Chemistry Lab Guidebook
	Solid phase extraction using an internal standard followed by polymethylsililation for GC/MS quantification and confirmation	1.0 ppb (zeranol) 4.0 ppb (taleranol)	NE	IE	Cattle, sheep liver, muscle	Sec. 5.051 FSIS Chemistry Lab Guidebook

FSIS RESIDUE ANALYTICAL CAPABILITY

Compound	Description	LDL/ MIC	TEST METHOD			Species/ Tissues	Reference
			MPL	Level/ Status			
Zinc	Dry ashed tissue is dissolved and quantified by AAS	NE	NE	IB	All/kidney liver muscle	Sec. 5.010 FSIS Chemistry Lab Guidebook	
	Dry ashed tissue is dissolved and quantified by inductively coupled plasma (ICP)	NE	16.0 ppb	IE	All/kidney liver muscle	Copy available upon request	

Section 4



1991 NATIONAL RESIDUE PROGRAM (NRP) PLAN--INTRODUCTION

Residue testing of animals slaughtered in the United States is divided into three major activities: **monitoring, surveillance, and exploratory projects.**

Monitoring is designed to provide profile information on the occurrence of residue violations in specified animal populations on an annual, national basis. Because the primary concern of monitoring is violations, the compounds considered for monitoring generally have established safe limits--tolerances or action levels. Compounds are selected for monitoring based on risk profiles and the availability of laboratory methodology that is suitable for regulatory purposes. Monitoring information is obtained through a statistically-based selection of random samples from healthy-appearing animals under inspection; area monitoring may be conducted where a localized potential problem appears. The information generated from monitoring is reviewed periodically to assist in the allocation of Agency resources.

In addition to profile information, monitoring provides a basis for further action. In particular, the results are used to identify producers marketing animals with violative concentrations of residues. When such producers subsequently offer animals for slaughter, the animals will be subjected to surveillance sampling and testing until compliance is demonstrated. Other auxiliary uses of the data are to indicate prevalence and concentrations of residues, to evaluate residue trends, and to identify problems within the industry for which educational or other corrective efforts may be needed. Thus monitoring not only gathers information, but also assists in deterring practices that lead to violative residues.

Monitoring samples collected by inspectors at slaughtering plants are sent for analysis either to one of three Food Safety and Inspection Service (FSIS) field laboratories or, as needed, to a laboratory under contract to FSIS. The results are usually reported within eight days after arrival at the laboratory. In most cases, the product will have passed into consumer channels and become untraceable. Because of this pragmatic limitation, some animals containing violative residues inevitably pass into consumer channels, in spite of the agency's efforts to limit this occurrence as much as possible. The consequences to human health, however, are minimal as long as the violative rate is low. Tolerances and action levels represent the maximum residue concentrations safe for daily consumption over a lifetime. Occasional consumption of products with slightly higher residues is unlikely to result in adverse health effects.

Surveillance is designed to investigate and control the movement of potentially adulterated products. The sampling is often purposely biased and is directed at particular carcasses or products in response to information from monitoring or other sources (e.g., industry members or a state agency), or from observations during ante-mortem or post-mortem inspection indicating that adulterating concentrations of residue may be present. In-plant testing procedures may be performed by the inspector, or samples may be submitted to an FSIS laboratory for analysis. Depending upon the weight of evidence that led to the testing, product may be retained until test results indicate the appropriate regulatory disposition. Laboratory testing of surveillance samples is completed as rapidly as possible and takes precedence over monitoring samples.

The 1991 NRP plan estimates the surveillance samples anticipated on the basis of historical data; however, the actual number required depends entirely upon the needs that arise. A major incident, such as the 1979 polychlorinated biphenyls (PCB's) contamination problem, could drastically alter the expected surveillance requirement and may require an adjustment of the monitoring plan.

Exploratory projects are conducted for a variety of reasons, but these activities, whatever their objective, have in common the fact that test results normally are not used to take regulatory action or to trigger follow-up surveillance testing. The design of an exploratory project is not suitable for this purpose.

Exploratory projects generally fall within the following two types:

Studies of the occurrence of residues for which no safe limits (i.e., tolerances or action levels) have been established

1991 NATIONAL RESIDUE PROGRAM (NRP) PLAN--INTRODUCTION

There are many chemicals (e.g., trace metals, industrial chemicals, and mycotoxins) that may be inadvertently present in animals yet have no established safe concentrations. Their consistent presence in food (and the resulting need for a tolerance or action level to protect public health) has not been established. FSIS may conduct studies to develop information on the frequency and concentrations at which such residues occur.

These studies may be nationwide or limited to specific geographic areas. Sample collection may be random and statistically based, or biased to obtain "worst case" information. The results are given either to the Food and Drug Administration (FDA) or the Environmental Protection Agency (EPA), which have responsibility for establishing tolerances for contaminants in food under the Federal Food, Drug and Cosmetic Act. Exploratory programs planned on a limited scale may be expanded if preliminary results cause greater concern and make acquiring comprehensive information more urgent.

Other projects as appropriate

These may be designed for various purposes, such as evaluating new methods and approaches to monitoring, or supplementing the information used in considering a compound for monitoring.

Domestic Quality Assurance

The Agency enters into "memorandums of understanding" with segments of the meat and poultry industry to provide assurance that when the animals are presented for slaughter they do not contain violative concentrations of chemical residues. This assurance is based both on reviewing records of critical control points in pre-slaughter management control programs and on residue testing in USDA-accredited laboratories. Because of this control and testing program at critical control points, these animals may be sampled under Quality Assurance sampling rather than under monitoring.

Import Program

Federal meat and poultry inspection laws require foreign countries exporting meat and poultry to the U.S. to impose inspection requirements at least equal to U.S. requirements. As part of the process for a foreign country satisfying the equal-to standard with respect to the U.S., the country must respond to a set of five questionnaires that are designed to obtain information regarding various risk areas. One of these risk areas is residues.

A critical process in the foreign inspection system is residue control and monitoring to ensure that no chemicals or drugs prohibited in animal production in the U.S. are used on animals in foreign countries whose products are destined for the U.S. consumer. Present statutes require that foreign residue control programs include random sampling of animals at slaughter, the use of approved sampling and analytical methods, testing of the target tissue for specific compounds, and testing for compounds identified as potential contaminants of meat and poultry exported to the U.S. In addition, every foreign country must submit annual residue monitoring plans and results of the previous year's testing.

FSIS's International Programs (IP) evaluates foreign residue control programs through the on-site observation of the foreign country's inspection system, including exporting plants, equipment, and laboratories, and through actual sampling of imported product at the time of entry into the U.S. Import reinspection performed by FSIS inspectors located at various ports-of-entry around the country is a check on the effectiveness of foreign inspection systems; a component of the import reinspection process is residue sampling. To ensure that representative samples are selected, a sample is chosen at random from the lot selected for reinspection. The criteria for acceptance or rejection of imported products are the same as those applied to U.S. meat and poultry products prepared under Federal inspection. When test results indicate a violative level of residue in an imported product, every effort is made to locate and destroy any product already in U.S. distribution channels. Subsequent shipments of the same product from the same establishment are retained at the port-of-entry until laboratory results are known. If results are negative, product is permitted to move into commerce; if positive, product is refused entry into the U.S. In addition, all shipments of like product from the country are placed on an increased testing schedule until a record of compliance is re-established.

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Annual Plan

The development of the yearly NRP Plan begins in February of the preceding year and progresses by means of discussions, both formal and informal, among the Residue Evaluation and Planning Division of the FSIS Science and Technology Program, other Science and Technology Divisions, other FSIS programs, and involved Federal Agencies; it culminates in formal reviews by FSIS and an interagency working group during the late summer and fall. The plan is based on a "residue/species pair" design concept. The species or production-class groups paired with residues are determined by commonalities in rearing as these factors affect the animal's exposure and the probability that residues may be present at slaughter. For example, market hogs have an exposure-potential profile different from that of boars and sows.

In 1983 FSIS asked the Food and Nutrition Board of the National Research Council (NRC) to evaluate the scientific basis of the present system for inspecting meat and poultry and meat and poultry products and to assess the National Residue Program. The NRC report *Meat and Poultry Inspection: The Scientific Basis of the Nation's Program*, published in 1985, contained a number of recommendations and described the characteristics of an ideal program. During fiscal year 1986, FSIS considered the mission and design of the residue program in terms of the NRC report. This review influenced portions of the 1986 plan and has had an additional impact on the plans from 1987 through 1991.

Although the projections upon which the plan is based are as exact as possible, they may not match budgetary or facility resources, or specific sampling and analytical capabilities or requirements during 1991. Residue control is a dynamic field, with continual change; the plan will be modified during the year as additional information alters the original assessment.

The following describes the tables in which the details of the plan are presented. Preceding the tables is an alphabetical list (with explanatory material) of the compounds included in the 1991 plan.

Table I

Table I lists the residue designations used in the 1991 plan, the compounds included under those designations that can be identified as violative, and the residue codes.

The analytical methods used, the minimal levels of measurement that can be achieved, and references to full descriptions of the methods can be found in the Analytical Capability section of this document. FSIS maintains a laboratory development and quality assurance program to ensure progress in residue testing and the integrity of its test results. Before an analyst is allowed to conduct a test on a monitoring or surveillance sample, he or she must demonstrate adequate proficiency and meet specified standards in analyzing quality-assurance samples. (Additional information on the quality-assurance program can be obtained from the Chemistry Division's Quality Assurance Handbook.)

Whenever possible, multi-residue methods are used to detect the presence of more than one residue in a sample; such procedures are used for chlorinated hydrocarbons, antibiotics, sulfonamides, and other classes of compounds. Some of the multi-residue methods detect the presence of additional compounds not included in this listing; however, the confirmation of identity or precise quantification of these additional residues may not be possible. Some compounds that are not significant public health concerns may be included because they are detected in multi-residue testing procedures. The multi-residue methods and the number of compounds that may be identified by each method are expanded when new or modified technology is available.

Table II

Table II lists the species or production-class groups normally used for a residue/species pair in a statistical design and the apportionment of samples between production classes. Exceptions to the groupings for particular compounds are made when appropriate.

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Table III

The number of samples for a given residue/species pair generally is chosen to ensure detection of a problem that affects a specified percentage of the population. Table III shows the relationships among the sample size required to detect a problem, the size of the problem, and the probability of detection.

The number of samples generally is chosen to provide a 95% probability of detecting at least one violation when one percent of the animal population sampled is violative. This requires approximately 300 samples. Ensuring a 95% probability of detecting a problem that affects 0.1 percent of the sampled population would require increasing the number of samples to approximately 3,000. When it is known or anticipated that a residue presents a significant public health problem, sampling may be increased. The increased sampling permits study of trends and geographic or seasonal variation in violation rates, and may aid in preparing effective control actions. Conversely, sample sets of fewer than 300 samples are appropriate when at least one of the following conditions pertains: a minor species is involved; it is known that the prevalence of residues in the species involved is low or apparently nonexistent; slaughter of the species occurs in only a few establishments; cost savings or more urgent demands necessitate the reduction of sampling or laboratory resources.

Collection requests for samples are generated monthly, using an FSIS computerized system in Washington, D.C. Sample and plant selection is random and statistically (probability) based by production class, with a minimal bias. Normally, residues are monitored for the entire year, but some may be introduced during the year and may continue into the following year. Others may be included only during a particular period of the year. Variables such as production volume, geography, and season are addressed statistically within resource constraints. In some cases where method development is incomplete, samples will be collected on a monthly basis but analytical work may be delayed until the methods are implemented.

Table IV

Table IV lists the tissues to be collected for domestic and import sample analysis.

Table V

Table V presents a summary of the combined domestic and import plans. The plans specify the sample units planned for analysis. In the domestic program a livestock sample unit represents one animal. With poultry, a sample unit can be from one animal when the target tissue is a large one such as fat or muscle or the liver in turkeys. In some cases, the target tissue, such as the liver in chicken, is too small to produce an adequate sample. A poultry sample can then be composed by commingling tissues from six birds.

Table VI

In themselves, sample numbers are not good indicators of the actual commitment of resources, or of the effectiveness of these commitments. Table VI illustrates the wide divergence among test procedures in amount of analyst time required per sample.

Table VII

Table VII presents the domestic program sample units planned for 1991, including monitoring, surveillance, and exploratory activities.

Tables VIII-IX

Tables VIII and IX show the monitoring and exploratory sample units planned for domestic livestock and poultry, respectively. The sample unit numbers for each residue designation are presented according to species or production class. The samples to be taken in the voluntary program for rabbits are estimated.

Table X

Table X presents the sample plan for imported products. The design of the import plan differs from the domestic plan because it involves the reinspection of product that has already been inspected under an ap-

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proved foreign system with a residue program equal to that of the U.S. Thus port-of-entry residue sampling is intended to provide further information on the operation of the foreign system's residue controls.

The import inspection program uses an Automated Import Information System (AIIS) to direct the selection of samples from any port where product may arrive. Data stored in the AIIS are used for monthly updates of the sampling requirements for each country, product, and residue class, to ensure that the commitments of the annual plan are met. Appropriate changes can be made in the AIIS if, during the course of the year, there are unexpected changes in the volume or type of imported product from any country or countries.

Tables XI-XII

Table XI shows the planned import samples by species and Table XII shows estimated analyses per country.

Tables XIII-XXII

Table XIII shows the estimated annual volume of imported beef, divided into fresh (including frozen) and cured/cooked products. Table XIV lists the sample unit analyses planned for fresh and cooked/cured beef products. Tables XV and XVI follow the same procedure for imported pork; Tables XVII and XVIII for fresh veal, mutton, and lamb; Tables XIX and XX for ducks/geese and turkeys; and Tables XXI and XXII for chickens and goats.

Compounds Included In the 1991 Residue Plan

Antibiotics

During the last decade antibiotic use in food animals, as in human medicine, has been increasingly directed against specific conditions and less toward general therapy or disease prevention. Nevertheless, some antibiotics continue to be fed at subtherapeutic concentrations to enhance feed efficiency and promote growth.

The antibiotics vary widely in their toxicity, safe residue concentrations, and required withdrawal periods. Toxic effects include, for example, life-threatening hypersensitivity responses (penicillins) and hearing impairment (streptomycins). In addition, there is concern about the development and transmission of pathogenic organisms resistant to antibiotic therapy.

The conventional bioassays and ELISA's currently in use by FSIS will identify penicillins, streptomycins, tetracyclines, chloramphenicol, neomycin, erythromycin, gentamicin, and tylosin.

Calves have presented a high percentage of violative antibiotic residues. Until 1988, calves were sampled as a single class. Since 1988 calves tested under surveillance have been divided into four groups: bob (up to 3 weeks of age or 150 pounds in weight); formula-fed calves between 150 and 400 pounds; non-formula calves between 150 and 400 pounds; and heavy calves (over 400 pounds).

Formula-fed calves are a problem because they are slaughtered at three or four months. Consequently, they may retain residues of some long-acting antibiotics in their kidneys or other tissues.

Bob calves present an acute problem, as they are slaughtered before many drugs that might be administered can deplete to safe concentrations. FSIS conducts an intensive in-plant testing program --the Calf Antibiotic and Sulfonamide Test (CAST) program--directed at violative antibiotic and sulfonamide residues in bob calves.

Cows presented for slaughter are usually culled from beef or dairy herds for substandard performance and may have been treated before slaughter. Consequently, cows also have had a relatively high percentage of violative residues. Since cows are often presented for slaughter singly or in small lots, it has proved difficult to trace violative carcasses found in monitoring to their place of origin for follow-up surveillance testing. FSIS

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has an in-plant testing program for cows suspected of containing violative residues--the Swab Test on Premises (STOP) program--that has been effective over the years in reducing the previously very high violation rate in this vulnerable group of animals. All cows sampled under the national monitoring program will be concurrently screened by the STOP test. Carcasses that are STOP-positive will be retained pending confirmation of adulteration by laboratory analysis. Before 1989 both beef and dairy cows were grouped together with bulls as a single production class; since 1990 dairy cows have been sampled separately from beef cows. All fresh imported product will be sampled and tested for antibiotics in 1991.

Sulfonamides

Sulfonamides are bacterial and protozoal suppressant drugs that have been widely used in animals and humans since the early 1940's. They continue to be popular because of their economic advantages and wide spectrum of activity. Toxic effects include renal damage, thyroid degeneration, and allergy. Sulfonamides that can be determined as violative include sulfachlorpyridazine, sulfadimethoxine, sulfaethoxyypyridazine, sulfamethazine, and sulfathiazole. Sulfadiazine, sulfadoxine, sulfamethoxyypyridazine, sulfaphenazole, sulfapyridine, sulfaquinoxaline, sulfatroxazole, and sulfisoxazole are also detectable.

Domestic monitoring samples are planned for 1991 in all species/production groups. Monitoring samples from market hogs will be continued at 3,600 so as to provide monthly estimates of the frequency of violative concentrations. In the import plan, all commodities will be sampled for sulfonamide testing.

Arsenic

Organic arsenical compounds, either alone or combined with other compounds, have been widely used both in humans and in food-producing animals as tonics, restoratives, herbicides, pesticides, protozoal and helminthologic agents, antimicrobials, and growth promoters. They are approved for use in poultry as growth promoters and, in conjunction with other compounds, as coccidiostats; they are used in swine as growth promoters and to prevent bacterial enteritis.

When arsenicals are used as approved in chickens and swine, the animals or birds must not be treated with or exposed to the arsenical compounds within five days of slaughter. This five-day withdrawal period is sufficient to ensure that concentrations of arsenic in the tissues are lower than the tolerance concentrations.

Inorganic arsenicals have been linked to skin, lung, and liver cancer. The organic arsenical compounds used in food animal production do not seem to have carcinogenic or irritant effects.

Arsenic is included in the domestic monitoring plan for horses, cows, goats, market hogs, and young chickens and turkeys. The imported products to be tested for the presence of arsenic include fresh and processed pork, goats, fresh turkeys and chickens and processed turkey and chicken products.

Benzimidazoles

The five benzimidazoles detected by FSIS's current method that can be confirmed as violative are albendazole, benomyl, fenbendazole, oxfendazole, and thiabendazole and its metabolite. These compounds are variously used as pesticides, and as anthelmintics in several species for treatment of gastrointestinal or lung worms.

Undesirable side effects frequently encountered in human beings treated with benzimidazoles are anorexia, nausea, vomiting, and dizziness. Less frequently noticed are diarrhea, epigastric distress, drowsiness, and headache.

In 1991 cattle, sheep, lambs, goats, market hogs, and young chickens will be tested for benzimidazoles. Imported beef, veal, pork, mutton and lamb, goats, and chicken will also be sampled and tested for these compounds.

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Carbadox

Carbadox is approved for use in swine weighing less than 75 pounds to prevent or treat enteritis and for increased feed efficiency and weight gain. The last exposure of swine to carbadox must be at least 10 weeks before slaughter. The parent compound is a liver carcinogen. In 1991 domestic market hogs, boars, and sows will be monitored, and surveillance sample unit analyses are projected to test for the presence of carbadox in roaster pigs. As carbadox is approved in other countries for use with swine, it is included in the import plan for pork.

Carbamates

Carbamates are primarily systemic insecticides and acaricides but are also used extensively as soil treatments and as topical and knockdown agents for ectoparasites and other pests. Carbamates are cholinesterase inhibitors and are generally neurotoxic. Symptoms of toxicity include nausea, vomiting, diarrhea, and dyspnea.

Analysis for carbamates includes aldicarb and its two metabolites, carbaryl, and carbofuran and its metabolite 3-hydroxycarbofuran. During 1991, 1,300 domestic monitoring samples from dairy cows, veal calves, and ducks will be analyzed for these carbamates; in the import plan, beef and veal will be sampled. An exploratory project in several classes of animals will include bendiocarb, bufencarb, 3,5-Dimethyl-4-(methylthio)phenyl methylcarbamate and its metabolite 3,5-Dimethyl-4-(methylsulfinyl)phenyl methylcarbamate, dioxacarb, isoprocarb, methomyl, oxamyl, promacarb, and propoxur .

Chlorinated Herbicides

This group of compounds, many of which are used extensively, are selective herbicides, insecticides, and preservatives. Many of these compounds have been cancelled or restricted due to concern regarding mutagenicity, carcinogenicity, and teratogenicity. For example, pentachlorophenol (PCP) has been used in the past as a wood preservative, herbicide, and insecticide; currently, only wood preservative uses are permitted. The use of PCP in wood manufacturing is declining; however, wood shavings and sawdust from PCP-treated boards may be used inadvertently as animal bedding.

The method, developed by Hopper, identifies bromoxynil, 2,4-D, dicamba, PCP, silvex, and triclopyr. Results from the screen will be reported as exploratory data.

Chlorinated Hydrocarbons and Organophosphates (CHC/COP's)

FSIS laboratories use multi-residue and confirmatory analytical procedures that can identify aldrin, BHC, captan, chlordane, DDT and metabolites, dieldrin, dodecachlorooctahydro-1,3,4-metheno-2H-cyclobuta[cd]pentalene [mirex], toxaphene, endosulfan, endrin, heptachlor and heptachlor epoxide, HCB, lindane, linuron, methoxychlor, PCB's, and terpene polychlorinated. In 1987 the chlorinated hydrocarbon method was modified slightly to include residues in fat from a group of chlorinated organophosphates. The domestic samples tested for chlorinated hydrocarbons yield results for seven chlorinated organophosphates: carbophenothion, 2-chloro-1-(2,4-dichlorophenyl)vinyl diethyl phosphate [chlorfenvinphos], 2-chloro-1-(2,4,5-trichlorophenyl)vinyl dimethyl phosphate [stirofos], chlorpyrifos, coumaphos, phosalone, and ronnel.

Most of these compounds are potent and persistent pesticides the use of which has been discontinued or severely restricted because of concerns regarding mutagenicity, carcinogenicity, hazard to wildlife, and bioaccumulation. Accumulation of chlorinated hydrocarbons in body fat may result in concentrations 10 to 30 times as great as in the food supply. Metabolism and excretion are slow, and the biological half-life of these compounds may be several months in mammals and several years in arid soils. Their persistence and potency make them effective long-term pesticides but also cause their continuing though diminishing occurrence as residues in meat and poultry products. Many uses are currently cancelled or restricted.

During 1991 analyses are planned for all domestic and imported species and production classes.

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DES

Diethylstilbestrol (DES) is an estrogenic compound once approved for use to increase feed efficiency and the rate of weight gain. DES was banned from use in 1979 when it was linked to cancer in humans. Some illegal use was detected in fancy veal calves in 1981. Domestic monitoring activities for DES include 300 samples from domestic heifers and steers. Imported fresh beef will be sampled for DES.

Halofuginone

Halofuginone is a coccidiostat for young chickens and young turkeys. In higher doses halofuginone is a growth depressant, impairs feed utilization, and reduces feed intake. In rats it causes alopecia. The compound is prohibited from use during the last four days before slaughter. Domestic and imported young chickens and turkeys will be monitored for halofuginone in 1991.

Ivermectin

Ivermectin is a macrocyclic lactone compound active at extremely low doses against a wide variety of nematode and arthropod parasites. Ivermectin is teratogenic in the rat, rabbit, and mouse. Most domestic and imported livestock species will be monitored for ivermectin.

Nicarbazin

Nicarbazin is a coccidiostat used in young and mature chickens. In 1991, 600 domestic samples will be tested for nicarbazin.

Nitroimidazoles

A nitroimidazole (ipronidazole) was previously approved for domestic use to control blackhead in turkeys and in other countries to treat or prevent enteritis in swine. It is a suspect carcinogen in experimental animals.

In 1991 samples for the nitroimidazoles (ipronidazole and dimetridazole) will be collected from imported pork and turkeys, and domestic young turkeys.

Pyrethrins/pyrethroids

Pyrethrins are a group of natural insecticides obtained chiefly from the flowers of *Crysanthemum cinerariaefolium*. These compounds are used widely because their mammalian toxicity is low relative to their insecticidal properties. Pyrethroids, for example, permethrin, are synthetic compounds that mimic the biological activities of the natural pyrethrins.

The 1991 domestic monitoring program will include sampling of dairy cows and formula-fed calves for cyano (3-phenoxyphenyl) methyl-4-chloro-*a*-(methylethyl) benzeneacetate, cypermethrin, flucythrinate, and permethrin.

TABLE I: Compounds in 1991 Residue Plan

Residue Designation	Compounds	Residue Code
ANTIBIOTICS		
	Chlortetracycline	209
	Erythromycin	206
	Gentamicin	211
	Neomycin	207
	Oxytetracycline	208
	Penicillins	201
	Streptomycin	202
	Tetracycline	204
	Tylosin	205
SULFONAMIDES		
	Sulfabromomethazine	811
	Sulfachloropyrazine	806
	Sulfachlorpyridazine	802
	Sulfadimethoxine	803
	Sulfaethoxypyridazine	801
	Sulfamethazine	805
	Sulfanitran	804
	Sulfathiazole	809
ARSENIC		924
BENZIMIDAZOLES		
	Albendazole	951
	Benomyl	957
	Fenbendazole	952
	Oxfendazole	955
	Thiabendazole and metabolite	953
CARBADOX		907
CARBAMATES		
	Aldicarb and metabolites	602
	Carbaryl	601
	Carbofuran	605
CHLORINATED HERBICIDES		
	Bromoxynil	704
	2,4-D	701
	Dicamba	705
	Pentachlorophenol (PCP)	723
	Silvex	706
	Triclopyr	707

TABLE I: Compounds in 1991 Residue Plan

Residue Designation	Compounds	Residue Code
CHC/COP's	Aldrin	101
	BHC	102
	Captan	151
	Chlordane (technical)	103
	Carbophenothion	318
	2-Chloro-1-(2,4,-dichlorophenyl) vinyl diethyl phosphate [chlorfenvinphos]	320
	2-Chloro-1-(2,4,5-trichlorophenyl) vinyl dimethyl phosphate [stirofos]	314
	Chlorpyrifos	315
	Coumaphos and oxygen analog	301
	Dieldrin	104
	DDT and metabolites	105
	Dodecachlorooctahydro-1,3,4-metheno-2H- cyclobuta[cd]pentalene [mirex]	113
	Endosulfan	152
	Endrin	106
	HCB	112
	Heptachlor and heptachlor epoxide	107
	Lindane	108
	Linuron	153
	Methoxychlor	109
	PCB's	111
	Phosalone	154
	Ronnel	307
	Toxaphene	110
DES		501
HALOFUGINONE		926
IVERMECTIN		923
NICARBAZIN		928
NITROIMIDAZOLES	Dimetridazole	961
	Ipronidazole	962
PYRETHRINS/PYRETHROIDS	Cyano (3-phenoxyphenyl) methyl-4-chloro- a-(methyl-ethyl) benzeneacetate	083
	Cypermethrin	081
	Flucythrinate	084
	Permethrin	085

TABLE II: Groups for Residue Evaluation

Species/Production Classes	Percent
Horses	
Bulls/Beef Cows	(20/80)
Dairy cows	
Heifers/Steers	(40/60)
Calves	
<i>Bob</i>	
<i>Formula-fed</i>	
<i>Non-formula</i>	
<i>Heavy</i>	
Sheep/Lamb (Seasonal)	(10/90)
Goats	
Hogs, market	
Sows/Boars	(80/20)
Chickens, young	
Chickens, mature	
Turkeys, young ¹ (Seasonal)	
Turkeys, mature ² (Seasonal)	
Ducks	
Geese (Seasonal)	
Rabbits	

1 Normally 26 weeks old.

2 Breeding stock.

TABLE III: NUMBER OF SAMPLES REQUIRED TO ENSURE DETECTION OF A PROBLEM THAT AFFECTS A GIVEN PERCENTAGE OF THE SAMPLED POPULATION

Percentage Violative in Sampled Population	Probability of Detection (Percent)			
	90	95	99	99.9
	Samples Required			
10	22	29	44	66
5	45	59	90	135
1	230	299	459	688
0.5	460	598	919	1,379
0.1	2,302	2,995	4,603	6,905
0.05	4,605	5,990	9,209	13,813

TABLE IV: Target Sample Tissues to be Collected for Analysis in 1991

Residue Designation	Species Sampled	Substrate Analyzed¹
Antibiotics	Cattle Chickens Ducks Geese Goats Horses Rabbits Sheep Swine Turkeys	Kidney, liver, muscle²
Sulfonamides	Cattle Chickens Ducks Geese Goats Horses Rabbits Sheep Swine Turkeys	Urine, liver, muscle³
Arsenic	Cattle Chickens Goats Horses Swine Turkeys	Liver, muscle
Benzimidazoles	Cattle Chickens Goats Sheep Swine	Liver, muscle
Carbadox	Swine	Liver, muscle
Carbamates	Cattle Ducks	Liver, muscle

1 Tissues in bold-face type submitted for monitoring samples; for surveillance samples, all tissues submitted.

2 Liver to be analyzed if kidney is violative; muscle to be analyzed if liver is violative.

3 Urine submission optional; if urine is positive, then liver is analyzed; if liver is positive, then muscle is analyzed.

TABLE IV: Target Sample Tissues to be Collected for Analysis in 1991

Residue Designation	Species Sampled	Substrate Analyzed¹
Chlorinated Herbicides	Cattle Chickens Ducks Goats Horses Sheep Swine Turkeys	Fat
Chlorinated Hydrocarbons and Organophosphates (CHC/COP's)	Cattle Chickens Ducks Geese Goats Horses Rabbits Sheep Swine Turkeys	Fat
DES	Cattle Sheep	Liver, muscle
Halofuginone	Chickens Turkeys	Liver, muscle
Ivermectin	Cattle Goats Horses Sheep Swine	Liver, muscle
Nicarbazin	Chickens	Liver
Nitroimidazoles	Swine Turkeys	Muscle
Pyrethrins/pyrethroids	Cattle	Fat

¹ Tissues in bold-face type submitted for monitoring samples; for surveillance samples, all tissues submitted.

TABLE V: 1991 Domestic and Import Sample Unit Analyses

Residue Designation	Domestic	Import	Totals
Antibiotics	22,100	2,932	25,032
Sulfonamides	16,800	4,662	21,462
Arsenic	1,850	1,285	3,135
Benzimidazoles	3,100	2,694	5,794
Carbadox	750	2,033	2,783
Carbamates	1,320	798	2,118
Chlorinated Herbicides	4,200	2,852	7,052
Chlorinated Hydrocarbons and Organophosphates (CHC/COP's)	17,000 ¹	5,586 ²	22,586
DES	400	345	745
Halofuginone	1,300	93	1,393
Ivermectin	3,200	1,210	4,410
Nicarbazin	600	66	666
Nitroimidazoles	610	1,151	1,761
Pyrethrins/pyrethroids	800	318	1,118
Totals	74,030	26,025	100,055

1 Seven chlorinated organophosphates are included in domestic analyses for chlorinated hydrocarbons.

2 CHC's only.

TABLE VI: 1991 Domestic and Import Sample Unit Analyses

Residue Designation	Total Sample Unit Analyses	Estimated Lab Time Per Analysis (Hours)	Estimated Total LabTime (X100 Hours)
Antibiotics	25,032	0.55	137.68
Sulfonamides	21,462	0.95	203.89
Arsenic	3,135	0.51	15.99
Benzimidazoles	5,794	0.85	49.25
Carbadox	2,783	2.00	55.66
Carbamates	2,118	3.00	63.54
Chlorinated Herbicides	7,052	1.5	105.78
CHC/COP's	22,586	1.00	225.86
DES	745	1.50	11.18
Halofuginone	1,393	2.70	37.61
Ivermectin	4,410	1.15	50.72
Nicarbazin	666	1.15	7.66
Nitroimidazoles	1,761	2.00	35.22
Pyrethrins/pyrethroids	1,118	1.35	15.09
Totals	100,055		1,015.13

TABLE VII: 1991 Domestic Sample Unit Analyses

Residue Designation	Monitoring	Surveillance	Exploratory	Totals
Antibiotics	6,100	7,000	---	13,100
STOP	---	5,500	---	5,500
CAST	---	3,500	---	3,500
Sulfonamides	9,800	7,000	---	16,800
Arsenic	1,700	150	---	1,850
Benzimidazoles	2,800	300	---	3,100
Carbadox	600	150	---	750
Carbamates	1,300	20	---	1,320
Chlorinated Herbicides	---	---	4,200	4,200
Chlorinated Hydrocarbons and Organophosphates (CHC/COP's)	12,500	4,500	---	17,000
DES	300	100	---	400
Halofuginone	1,200	100	---	1,300
Ivermectin	3,100	100	---	3,200
Nicarbazin	600	---	---	600
Nitroimidazoles	600	10	---	610
Pyrethrins/pyrethroids	600	200	---	800
Totals	41,200	28,630	4,200	74,030

**TABLE VIII: 1991 Domestic Monitoring and Exploratory
Sample Unit Analyses: Livestock**

Residue Designation	Horses	Bulls/Beef Cows	Dairy Cows	Heifers/ Steers	Bob Calves	Formula- fed Calves	Non-formula Calves	Heavy Calves	Seasonal					
									Sheep/ Lamb	Goats	Market Hogs	Boars/ Sows	Totals	
Antibiotics	100	300	300	300	600	1,200	300	300	300	300	300	300	300	4,600
Sulfonamides	100	300	300	300	600	1,200	300	600	300	300	100	3,600	600	8,300
Arsenic	100	300	300	---	---	---	---	---	---	---	100	300	---	1,100
Benzimidazoles	---	300	300	300	---	300	300	300	300	300	100	300	---	2,500
Carbadox	---	---	---	---	---	---	---	---	---	---	---	300	300	600
Carbamates	---	---	600	---	---	300	300	---	---	---	---	---	---	1,200
Chlorinated Herbicides	100	300	300	300	---	300	300	300	300	300	100	300	300	2,900
CHC/COP's	100	300	300	3,000	---	300	300	300	300	300	100	300	300	5,600
DES	---	---	---	300	---	---	---	---	---	---	---	---	---	300
Ivermectin	100	300	300	300	---	300	300	300	300	300	300	300	300	3,100
Nitroimidazoles	---	---	---	---	---	---	---	---	---	---	---	300	---	300
Pyrethrins/pyrethroids	---	---	300	---	---	300	---	---	---	---	---	---	---	600
Totals	600	2,100	3,000	4,800	1,200	4,200	2,100	2,100	1,800	1,800	1,100	6,000	2,100	31,100

TABLE IX: 1991 Domestic Monitoring and Exploratory Sample Unit Analyses: Poultry and Rabbits

Residue Designation	Chickens Young	Chickens Mature	Turkeys Young Seasonal	Turkeys Mature Seasonal	Ducks	Geese	Rabbits	Totals
Antibiotics	300	300	300	300	100	100	100	1,500
Sulfonamides	300	300	300	300	100	100	100	1,500
Arsenic	300	---	300	---	---	---	---	600
Benzimidazoles	300	---	---	---	---	---	---	300
Carbamates	---	---	---	---	100	---	---	100
Chlorinated Herbicides	300	300	300	300	100	---	---	1,300
CHC/COP's	3,000	300	3,000	300	100	100	100	6,900
Halofuginone	600	---	600	---	---	---	---	1,200
Nicarbazin	300	300	---	---	---	---	---	600
Nitroimidazoles	---	---	300	---	---	---	---	300
Totals	5,400	1,500	5,100	1,200	500	300	300	14,300

TABLE X: 1991 Estimated Import Sample Unit Analyses

Residue Designation

Antibiotics	2,932
Sulfonamides	4,662
Arsenic	1,285
Benzimidazoles	2,694
Carbadox	2,033
Carbamates	798
Chlorinated Herbicides	2,852
Chlorinated Hydrocarbons	5,586
DES	345
Halofuginone	93
Ivermectin	1,210
Nicarbazin	66
Nitroimidazoles	1,151
Pyrethrins/pyrethroids	318
Total	26,025

TABLE XI: 1991 Estimated Import Sample Unit Analyses

Residue Designation	Beef	Pork	Veal	Mutton/Lamb	Goats	Poultry	Totals
Antibiotics	1,496	698	352	166	57	163	2,932
Sulfonamides	2,533	1,305	396	166	57	205	4,662
Arsenic	---	1,075	---	---	57	153	1,285
Benzimidazoles	1,151	1,123	169	166	57	28	2,694
Carbadox	---	2,033	---	---	---	---	2,033
Carbamates	626	---	111	---	---	61	798
Chlorinated Herbicides	916	1,250	142	243	57	244	2,852
Chlorinated Hydrocarbons	2,314	1,909	211	546	221	385	5,586
DES	345	---	---	---	---	---	345
Halofuginone	---	---	---	---	---	93	93
Ivermectin	452	491	104	121	42	---	1,210
Nicarbazin	---	---	---	---	---	66	66
Nitroimidazoles	---	1,090	---	---	---	61	1,151
Pyrethrins/pyrethroids	318	---	---	---	---	---	318
Totals	10,151	10,974	1,485	1,408	548	1,459	26,025

**TABLE XII: 1991 Estimated Import Sample
Unit Analyses Per Country**

Country	Beef	Pork	Veal	Mutton/lamb	Goats	Poultry ¹	Totals
Argentina	484	---	---	---	---	---	484
Australia	3,843	141	120	797	476	---	5,377
Belgium	---	103	---	---	---	---	103
Canada	1,453	5,792	664	48	---	1,056	9,086
Costa Rica	287	---	56	---	---	---	343
Czechoslovakia	---	72	---	---	---	---	72
Denmark	---	3,040	---	---	---	---	3,040
Dominican Republic	283	---	---	---	---	---	283
El Salvador	97	---	---	---	---	---	97
Finland	---	163	---	---	---	---	163
France	32	48	---	---	---	87	167
Germany	---	40	---	---	---	---	40
Guatemala	321	---	---	---	---	---	321
Honduras	250	---	---	---	---	---	250
Hong Kong	---	---	---	---	---	126	126
Hungary	32	166	---	---	---	---	198
Ireland	73	72	---	---	---	---	145
Israel	---	---	---	---	---	158	158
Italy	24	48	---	---	---	---	72
Japan	72	---	---	---	---	---	72
Mexico	77	32	---	---	---	---	109
Netherlands	32	178	---	---	---	---	210
New Zealand	2,609	---	589	563	72	---	3,833
Poland	---	329	---	---	---	---	329
Romania	---	48	---	---	---	---	48
Sweden	89	333	56	---	---	---	478
Switzerland	24	49	---	---	---	---	73
United Kingdom	---	---	---	---	---	32	32
Uruguay	45	---	---	---	---	---	45
Yugoslavia	24	320	---	---	---	---	344
Totals	10,151	10,974	1,485	1,408	548	1,459	26,025

¹Includes chickens, turkeys, ducks, geese, and guinea fowl.

TABLE XIII: Estimated Annual Volume of Imported Beef

Country	Estimated Annual Imports (lbs)	Fresh Product (lbs)	Processed Product (lbs)
Argentina	121,228,510	---	121,228,510
Australia	773,319,702	773,058,313	261,389
Canada	216,348,880	207,583,777	8,765,103
Costa Rica	33,239,307	33,239,307	---
Dominican Republic	32,589,289	32,589,289	---
El Salvador	3,057,398	3,057,398	---
France	NA	NA	NA
Guatemala	39,373,867	39,373,867	---
Honduras	24,116,599	24,116,599	---
Hungary	441,687	---	441,687
Ireland	212,221	44,100	168,121
Italy	264,089	---	264,089
Japan	NA	NA	NA
Mexico	1,870,135	1,870,135	---
Netherlands	1,828	---	1,828
New Zealand	506,379,634	505,097,648	1,281,986
Sweden	3,286,092	3,246,264	39,828
Switzerland	32,147	---	32,124
Uruguay	8,762,530	---	8,762,530
Yugoslavia	794,117	---	794,117

TABLE XIV: 1991 Imported Beef Sample Unit Analyses for Fresh (F) and Processed (P) Product

Country	Anti-biotics F	Sulfon-amides F/P	Benzimid-azoles F	Carbamates- F	Chlorinated Herbicides F/P	Chlorinated Hydrocarbons F/P	DES F	Ivermectin F	Pyrethrins/ pyrethroids F	Total Est. Sample Unit Analyses
Argentina	---	190	---	---	80	214	---	---	---	484
Australia	600	1,000	500	200	300	818	142	194	89	3,843
Canada	200	338	200	100	100	381	38	57	39	1,453
Costa Rica	62	52	26	32	24	59	8	8	16	287
Dominican Republic	62	51	25	32	24	57	8	8	16	283
El Salvador	8	8	9	16	16	8	8	8	16	97
France	---	8	---	---	16	8	---	---	---	32
Guatemala	67	62	31	32	28	69	8	8	16	321
Honduras	65	38	25	32	16	42	8	8	16	250
Hungary	---	8	---	---	16	8	---	---	---	32
Ireland	8	8	9	8	8	8	8	8	8	73
Italy	---	8	---	---	8	8	---	---	---	24
Japan	8	8	8	8	8	8	8	8	8	72

TABLE XIV: 1991 Imported Beef Sample Unit Analyses for Fresh (F) and Processed (P) Product

Country	Anti-biotics	Sulfon-amides	Benzimid-azoles	Carbamates	Chlorinated Herbicides	Chlorinated Hydro-carbons	DES	Ivermectin	Pyrethrins/pyrethroids	Total Est. Sample Unit Analyses
	F	F/P	F/P	F/P	F/P	F/P	F	F		
Mexico	8	8	9	8	8	8	8	8	12	77
Netherlands	---	8	---	---	16	8	---	---	---	32
New Zealand	400	700	300	150	200	571	93	129	66	2,609
Sweden	8	8	9	8	16	8	8	8	16	89
Switzerland	---	8	---	---	8	8	---	---	---	24
Uruguay	---	14	---	---	16	15	---	---	---	45
Yugoslavia	---	8	---	---	8	8	---	---	---	24
Totals	1,496	2,533	1,151	626	916	2,314	345	452	318	10,151

TABLE XV: Estimated Annual Volume of Imported Pork

Country	Estimated Annual Imports (lbs)	Fresh Product (lbs)	Processed Product (lbs)
Australia	2,375,897	2,375,897	---
Belgium	9,279,700	---	9,279,700
Canada	511,771,982	453,266,142	58,505,540
Czechoslovakia	1,632,737	---	1,632,737
Denmark	240,560,701	108,189,128	132,371,573
Finland	5,401,362	2,264,502	3,136,860
France	116,269	---	116,269
Germany	188,554	---	188,554
Hungary	22,281,401	---	22,281,401
Ireland	482,825	---	482,825
Italy	509,123	---	509,123
Mexico	4,079	---	4,079
Netherlands	19,585,212	---	19,585,212
Poland	38,401,331	---	38,401,331
Romania	472,324	---	472,324
Sweden	17,439,765	15,702,625	1,737,140
Switzerland	32,786	---	32,786
Yugoslavia	23,271,705	---	23,271,705

**TABLE XVI: 1991 Imported Pork Sample Unit Analyses
for Fresh (F) and Processed (P) Product**

Country	Antibiotics		Sulfonamides		Arsenic		Benzimidazoles		Carbadox		Chlorinated Herbicides		Chlorinated Hydrocarbons		Ivermectin		Nitroimidazoles		Total Est. Sample Unit Analyses
	F	F/P	F/P	F/P	F/P	F/P	F/P	F/P	F/P	F/P	F/P	F	F/P	F	F/P	F	F/P		
Australia	41	8	16	8	16	11	8	8	11	32	8	8	8	8	9	8	9	141	
Belgium	---	16	20	12	20	---	12	---	---	32	23	---	---	---	---	---	---	103	
Canada	421	700	500	600	500	1,000	600	1,000	1,000	500	1,000	---	---	---	700	---	---	5,792	
Czechoslovakia	---	8	16	8	16	---	8	---	---	32	8	---	---	---	---	---	---	72	
Denmark	150	300	300	300	300	800	300	800	800	300	500	---	---	---	300	---	---	3,040	
Finland	41	9	16	8	16	27	8	27	27	32	13	---	---	---	8	9	---	163	
France	---	8	8	8	8	---	8	---	---	16	8	---	---	---	---	---	---	48	
Germany	---	8	8	---	8	---	---	---	---	16	8	---	---	---	---	---	---	40	
Hungary	---	38	28	30	28	---	30	---	---	16	54	---	---	---	---	---	---	166	
Ireland	---	8	8	---	8	---	---	---	---	48	8	---	---	---	---	---	---	72	
Italy	---	8	8	8	8	---	8	---	---	16	8	---	---	---	---	---	---	48	
Mexico	---	8	8	---	8	---	8	---	---	8	8	---	---	---	---	---	---	32	
Netherlands	---	34	24	27	24	---	27	---	---	45	48	---	---	---	---	---	---	178	
Poland	---	66	48	51	48	---	51	---	---	64	100	---	---	---	---	---	---	329	
Romania	---	8	8	8	8	---	8	---	---	16	8	---	---	---	---	---	---	48	
Sweden	45	30	22	24	22	84	24	84	84	45	42	---	---	---	27	---	---	333	
Switzerland	---	8	8	---	8	---	---	---	---	16	8	---	---	---	9	---	---	49	
Yugoslavia	---	40	29	31	29	111	31	111	111	16	57	---	---	---	36	---	---	320	
Totals	698	1,305	1,075	1,123	1,075	2,033	1,250	1,909	491	1,090	10,974								

TABLE XVII: 1991 Imported Veal Sample Unit Analyses for Fresh (F) and Processed (P) Product

Country	Est. annual Imports (lbs)	Antibiotics		Sulfonamides		Benzimidazoles		Carbamates		Chlorinated Herbicides		Chlorinated Hydrocarbons		Ivermectin		Total Est. Sample Unit Analyses
		F		F/P		F/P		F		F/P		F		F		
Australia	2,731,946	29		32		14		8		12		17		8		120
Canada	16,295,524	162		184		74		46		61		94		43		664
Costa Rica	56,764	8		8		8		8		8		8		8		56
New Zealand	14,592,021	145		164		65		41		53		84		37		589
Sweden	3,810	8		8		8		8		8		8		8		56
Totals		352		396		169		111		142		211		104		1,485

TABLE XVIII: Imported Mutton and Lamb Sample Unit Analyses for Fresh (F) and Processed (P) Product

Country	Est. Annual Imports (lbs)	Antibiotics F	Sulfonamides F/P	Benzimidazoles F/P	Chlorinated Herbicides F/P	Chlorinated Hydrocarbons F/P	Ivermectin F	Total Est. Sample Unit Analyses
Australia	19,978,191	92	92	92	137	318	66	797
Canada	5,656	8	8	8	8	8	8	48
New Zealand	13,479,637	66	66	66	98	220	47	563
Totals		166	166	166	243	546	121	1,408

TABLE XIX: 1991 Imported Duck/Geese/Guinea Fowl Sample Unit Analyses for Fresh (F) and Processed (P) Product

Country	Est. Annual Imports (lbs)	Antibiotics F	Sulfonamides F/P	Carbamates F	Chlorinated Herbicides F/P	Chlorinated Hydrocarbons F/P	Total Est. Sample Unit Analyses
Canada	1,155,992	45	45	45	45	103	283
France	157,775	8	8	8	8	15	47
Israel	38,182	8	8	8	8	8	40
Totals		61	61	61	61	126	370

TABLE XX: 1991 Imported Turkey Sample Unit Analyses for Fresh (F) and Processed (P) Product

Country	Est. Annual Imports (lbs)	Antibiotics F	Sulfonamides F/P	Arsenic F/P	Chlorinated Herbicides F/P	Chlorinated Hydrocarbons F/P	Halofuginone F	Nitro-imidazoles F	Total Est Sample Unit Analyses
Canada	2,864,636	61	42	42	53	99	42	61	400
Hong Kong	983,907	---	14	14	21	37	---	---	86
Israel	852,367	---	14	14	18	32	---	---	78
United Kingdom	---	---	8	8	8	8	---	---	32
Totals		61	78	78	100	176	42	61	596

¹ Pounds not presently available; minimum number of sample unit analyses performed.

TABLE XXI: 1991 Imported Poultry (Chicken) Sample Unit Analyses for Fresh (F) and Processed (P) Product

Country	Est. Annual Imports (lbs)	Antibiotics		Sulfonamides		Arsenic		Benzimidazoles		Chlorinated Herbicides		Chlorinated Hydrocarbons		Halofuginone		Nicarbazin		Total Est. Sample Unit Analyses
		F	F/P	F/P	F/P	F	F	F	F/P	F	F	F/P	F	F	F	F		
Canada	8,480,043	41	42	51	28	59	59	51	42	373								
France	1,101	---	8	8	---	8	8	---	8	40								
Hong Kong	214,100	---	8	8	---	8	8	---	8	40								
Israel	686,183	---	8	8	---	8	8	---	8	40								
Totals		41	66	75	28	83	83	51	66	493								

TABLE XXII: Imported Goat Sample Unit Analyses for Fresh (F) Product

Country	Est. Annual Imports (lbs)	Antibiotics		Sulfonamides		Arsenic		Benzimidazoles		Chlorinated Herbicides		Chlorinated Hydrocarbons		Ivermectin		Total Est. Sample Unit Analyses
		F	F/P	F/P	F/P	F	F	F	F	F	F	F	F			
Australia	2,926,254	49	49	49	49	49	49	34	476							
New Zealand	352,725	8	8	8	8	8	8	8	72							
Totals		57	57	57	57	57	57	42	548							





■ COMPOUNDS CONSIDERED AND CRITERIA FOR EVALUATION

■ RESIDUE LIMITS

■ FSIS RESIDUE ANALYTICAL CAPABILITY

■ NATIONAL RESIDUE PROGRAM January--December, 1991